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PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

STRUCTURE REMOVAL ACTIVITIES CENTRAL AND WESTERN GULF OF MEXICO PLANNING AREAS

GULF OF MEXICO
OUTER CONTINENTAL SHELF
REGIONAL OFFICE

U.S. DEPARTMENT OF THE INTERIOR/MINERALS MANAGEMENT SERVICE

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Prepared by the
MINERALS MANAGEMENT SERVICE
GULF OF MEXICO
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April 1987

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ABBREVIATIONS AND ACRONYMS

ac	acre
CFR	Code of Federal Regulations
CGOM	Central Gulf of Mexico
cm/sec	centimeter per second
DOD	Department of Defense
DOT	Department of Transportation
EWTA	Eglin Water Test Area
FONSI	Finding of No Significant Impact
ft	foot
ft/sec	foot per second
GOM	Gulf of Mexico
ha	hectare
kg/sq cm	kilogram per square centimeter
m	meter
mg/l	milligram per liter
MMS	Minerals Management Service
MWA	Military Warning Area
NEPA	National Environmental Policy Act, as amended
NMFS	National Marine Fisheries Service
nmi	nautical mile
NTL	Notice to Lessees and Operators
OCS	Outer Continental Shelf
PEA	Programmatic Environmental Assessment
psi	pound per square inch
SEA	Site-Specific Environmental Assessment
sec	second
sq cm	square centimeter
sq km	square kilometer
sq m	square meter
sq mi	square mile
sq yd	square yard
U.S.C.	United States Code
USDC	United States Department of Commerce
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
WGOM	Western Gulf of Mexico
yd	yard

INTRODUCTION AND BACKGROUND

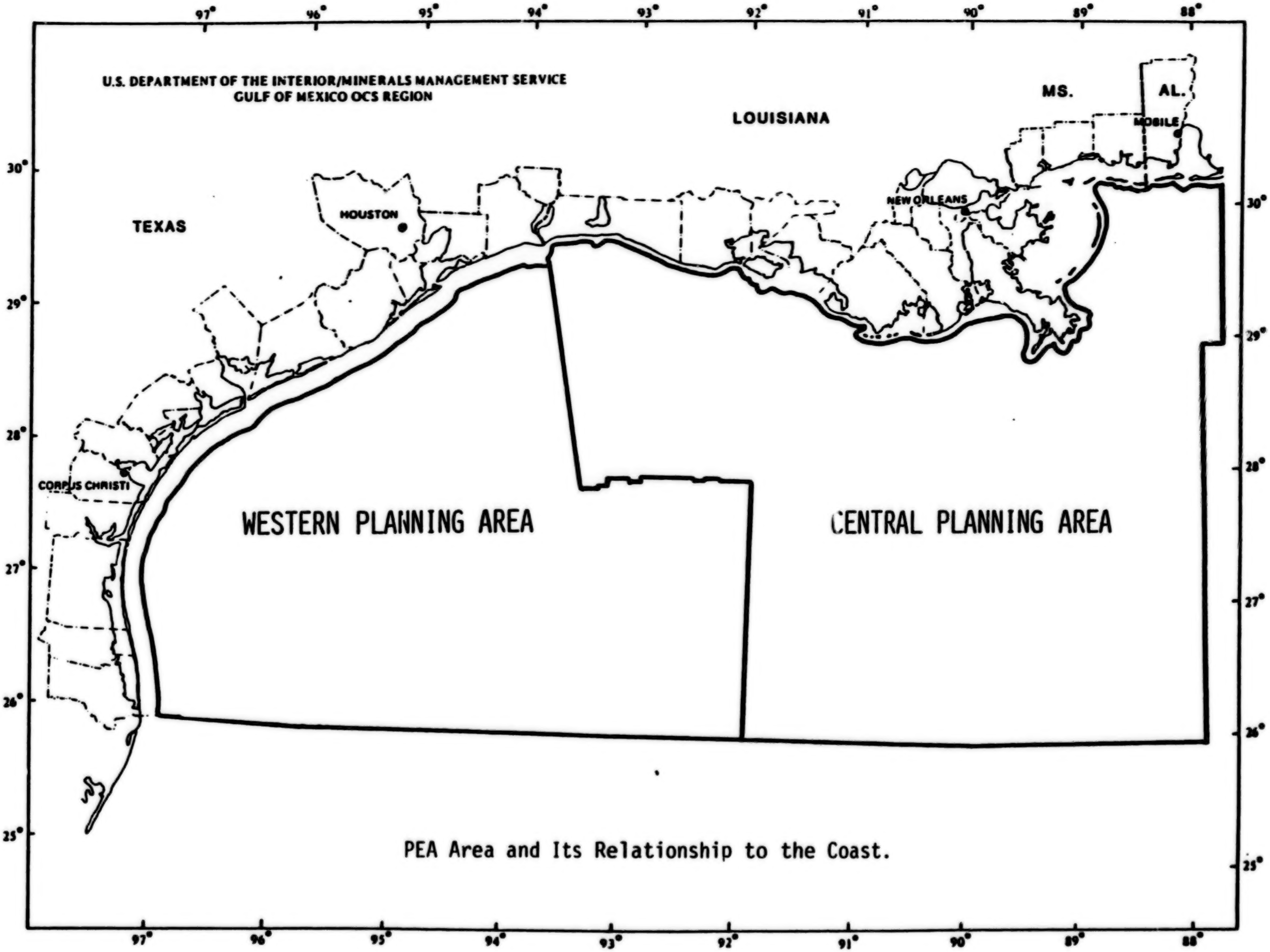
The purpose of this Programmatic Environmental Assessment (PEA) is to assess the spectrum of potential impacts associated with the removal of structures, e.g., platforms/caissons on blocks in the Central and Western Planning Areas of the Gulf of Mexico (GOM) Outer Continental Shelf (OCS). The PEA area and its relationship to the coast are shown in Figure A. The PEA/SEA process is designed to simplify and reduce the size of environmental assessment documents by eliminating repetitive discussions of the same issues. The PEA will serve as the base document for the structure-removal activities proposed within this portion of the GOM. A Site-Specific Environmental Assessment (SEA) will be prepared for each structure-removal proposal or for a group of proposed structure removals. Each SEA will conform to MMS and other appropriate guidelines for preparing environmental assessments and will utilize data presented in the PEA to complete the assessment. A SEA will contain site-specific data regarding the proposed structure removal(s) and an evaluation of the removal's potential impacts will be conducted. Mitigation measures may be generated to lessen potential impacts. The determination of whether a Finding of No Significant Impact (FONSI) is applicable or whether further assessment of the proposal(s) is necessary will be ascertained in the SEA.

The requirement for structure removals originates from legal and regulatory mandates to remove obsolete structures on the OCS. Section 22 of the current oil and gas lease form [MMS-2005 (March 1986)] states, "Within a period of 1 year after termination of this lease in whole or in part, the lessees shall remove all devices, works, and structures from the premises no longer subject to the lease in accordance with applicable regulations and orders of the Director." Title 30 CFR 250.18(d) states, upon termination of a right to use and easement, "...the grantee shall place in condition, remove, or otherwise dispose of all platforms...and other devices...and restore the premises to the satisfaction of the Director."

OCS Order 3, paragraph 2.9, requires lessees to remove all casing, wellhead equipment, and pilings to a depth of at least 16 ft (5 m) below the ocean floor. This order and NTL 81-5 require lessees to verify that the location has been cleared of all obstructions.

In December, 1986 there were 3,435 petroleum production structures on the Federal OCS within the PEA area. Approximately 90% of these are located off the coast of Louisiana and the remaining 10% are located off the coast of Texas. A recent report by the National Research Council (1985) indicates approximately 2,000 structures will be retired from petroleum production and scheduled for removal in the next 20 years. Historically, about 35 to 60 offshore structures are removed from Federal OCS waters each year. In 1984 and 1985, 49 and 61 platforms, respectively, were removed. MMS projects approximately 60 to 120 structure removals to take place each year for the next five years.

On April 15, 1986, the Galveston, Texas, laboratory of the National Marine Fisheries Service (NMFS) wrote a letter to the Regional Director, Gulf of Mexico OCS Region, MMS (Regional Director) and expressed concern regarding two major stranding events, one in fall 1985 and the second in summer 1986. On July 22, 1986, NMFS reported that some 124 stranded sea turtles and other animals had washed ashore on the upper Texas and Southwestern Louisiana coast since March 1986. Previous strandings observed in this area were less than 20 during similar time frames. Most of the strandings involved the endangered Kemp's ridley sea turtle. Additionally, wash-ups of dead fish and preborn porpoises were found with the stranded turtles. Coincidently, a number of structures in the State of Texas territorial waters were removed. NMFS suggested that a correlation exists



PEA Area and Its Relationship to the Coast.

Figure A

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between structure removals utilizing underwater explosives and the stranding of turtles and other animals.

The Endangered Species Act of 1973 (16 U.S.C. 1531-1543, 50 CFR 17), as amended, mandates that proposed actions not jeopardize the continued existence of an endangered or threatened species nor result in adverse modification or destruction of the species critical habitat. The Marine Mammal Protection Act of 1972 [16 U.S.C. 1361-1407, 86 Stat. 1027 (1972), 95 Stat. 979 (1981)], as amended, mandates the protection and conservation of marine mammals and their habitats. The Act specifically prohibits the harassing, hunting, capturing, or killing of any marine mammal unless otherwise exempted under provisions of the Act.

Considering the above concerns, the Regional Director sent a letter to all lessees and operators on August 19, 1986, requesting that the Regional Office in New Orleans, Louisiana, be notified 30 days in advance of any plans to remove structures. The Regional Director mailed a second letter to all lesses and operators on December 9, 1986, requesting additional information to facilitate MMS and NMFS interagency Endangered Species Act, Section 7 consultations for structure removals that involve the use of explosives. This letter requested each notification to include identification of the platform, its size, removal techniques to be employed, amount and type of explosives per charge (if applicable), and the number, size, and severing technique data for removal of the well conductors. Copies of these letters appear in Appendix A.

As lessees and operators began to respond with notifications for proposed structure removals, the need for a PEA was apparent. The PEA would serve as a reference document for preparing SEAs to assess the specific impacts associated with structure-removal operations.

In addition, Herbst prepared a technical assessment of structure removal techniques to assist in the SEA evaluations. See Appendix B for a copy of this assessment. Both nonexplosive and explosive structure-removal technologies are discussed.

As new data become available, this PEA may be revised or supplemented to incorporate the new information.

I. DESCRIPTION OF THE PROPOSAL AND NEED FOR THE PROPOSAL

The proposal is the removal of petroleum-related structures within the PEA area. To facilitate assessment of this proposal, each notification of a proposed structure removal will contain data requested by the Regional Director's letter to Lessees and Operators dated December 9, 1986. These data will describe the lessee's proposed activities for the structure removal. See Appendix A for a copy of this letter and its attached data request form. The MMS may contact the lessees or operators to clarify data or request additional information regarding the submitted information. This PEA will serve as the reference document in preparing SEAs for structure-removals. The SEAs will describe the specific activities of proposed structure-removals and any mitigation measures identified from consultations under Section 7 of the Endangered Species Act as well as any additional mitigation measures deemed appropriate by the MMS. These mitigation measures will be a condition to the MMS approval to conduct the proposed structure-removal activities.

The need for the proposal stems from legal and regulatory mandates to remove obsolete structures on the OCS. (See discussion in the Introduction and Background section of this PEA.) The data request form contains a purpose section in which the lessees or operators provide a discussion of the need for removing the structure. MMS will assess this rationale and other information provided in the data request form in its decision-making processes and determine if the structure-removal activities proposed by the lessees or operators should be approved as originally submitted, approved with required mitigation, or not approved.

II. ALTERNATIVES TO THE PROPOSED ACTION

Alternatives to approval of the proposed action as originally submitted include nonapproval or approval with required mitigation.

The nonapproval alternative results in leaving an obsolete structure in-place. This alternative requires both legal and regulatory reforms. Modification to Section 22 of the oil and gas lease form [MMS-2005 (March 1986)] will be necessary. In 30 CFR 250.18(d), the right of use and easement provisions allow facilities to be "...abandoned in-place as long as the Director determined that it does not constitute a hazard to navigation or commercial fishing." Lessees, however, would be faced with liabilities that may not be acceptable to them. The lessees would have to maintain the aids to navigation, cathodic protection, structural integrity, identification markings, structural paint, and satisfy many other requirements to safely leave the structure in-place. Vandalism, accidents with vessels (despite the aids to navigation), hurricanes, and other events could damage a structure and render it unsafe to remain in its current position. The potential that the block could be re-leased in a future sale will result in conflicts concerning the past lessee's and the future lessee's responsibilities regarding an abandoned-in-place structure on a block. Department of Defense usage of the OCS and strategic considerations may result in conflicts if abandoned structures are left in-place.

Leaving a structure in-place may have some recognizable benefits, e.g., maintaining artificial reef habitat, serving as a well-known "landmark" for recreational boats and helicopters, and an emergency structure in the event of an accident or severe storm.

The second alternative to the proposed action is approval of the proposal with mitigation. MMS feels the following mitigation measures are necessary for each structure removal or group of structure removals. (Impact level assessments were evaluated with these mitigation measures included in the proposal.)

1. The minimum explosive charge necessary to accomplish its designed mission is proposed in the structure-removal notification by the lessee(s).

2. Qualified observer(s) will be used to monitor the area surrounding the structure-removal site for detecting the presence of sea turtles and/or marine mammals prior to, during, and after detonation of "scare" and/or main charges.

3. Detonation of the main charges will be delayed (staggered) by a short interval to minimize the cumulative effects of the blasts.

4. If sea turtles and/or marine mammals are observed in the vicinity of the structure prior to detonation of the main charges, prop wash, acoustic devices, or other means available onsite will be used to remove them. "Scare" charges may be used if the onsite MMS and/or NMFS observer(s) deem this measure may be appropriate to remove these animals. Detonation of main charges will be prohibited if sea turtles and/or marine mammals are detected within approximately 1000m (3281 ft) of the structure-removal site. (This distance may be altered as additional data are developed from turtle impact studies or other data sources.)

In addition to these mitigation measures, the MMS and/or NMFS may require other mitigation measures deemed appropriate to protect sea turtles and/or marine mammals. These measures may include the following types of mitigation:

1. On the day of the main charge detonation, a survey (surface and/or aerial) using qualified observers, may be conducted prior to the detonation of these charges to check for the presence of sea turtles and/or marine mammals.

2. Company or contract divers may conduct main charge pre- and post-detonation surveys of the subsurface area surrounding the structure-removal site. During post-detonation surveys, specimens of killed animals may be collected by company or contract divers from the bottom and/or water column. Additionally, lessees or their operators should provide observers an opportunity to recover dead or injured sea turtles, marine mammals, and/or other readily accessible surface specimens affected by the detonation of the main charges.

Specific mitigation measures may be designed for each proposed structure removal. These mitigation measures will be based on the knowledge gained from the preceding structure removal operations, from studies conducted to ascertain the effectiveness of mitigation measures, and from practical experiences.

III. ENVIRONMENTAL EFFECTS, SOCIOECONOMIC CONCERNS, AND OTHER CONSIDERATIONS

The following table provides an overview of the levels of potential impacts for explosive and nonexplosive structure-removal activities and for the alternative of leaving a structure in-place. Each resource category is referenced to its corresponding section in this PEA. The rationales for the levels of impacts are developed in the narratives of this section. Mitigation measures were incorporated into the narratives and into the levels of potential impacts for each resource category.

Table III-1

Potential Impact Levels for Structure-Removal Activities in the PEA Area

Resource Category	Corresponding PEA Section	Explosive Structure Removals	Nonexplosive Structure Removals	Leaving Structure In-Place
PHYSICAL ENVIRONMENT				
Environmental Geology and Geologic Hazards	III.A.1.	NE	NE	NE
Meteorological Conditions	III.A.2.	NE	NE	VL
Physical Oceanography	III.A.3.a.	NE	NE	NE
Chemical Oceanography	III.A.3.b	VL	VL	NE
Water Quality	III.A.4.	L	L	NE
Air Quality	III.A.5.	VL	VL	NE
BIOLOGICAL ENVIRONMENT				
Coastal Habitats	III.B.1.	NE	NE	NE
Birds (Protected, Endangered, and/or Threatened Species)	III.B.2.a.	NE	NE	NE
Marine Mammals (Protected, Endangered, and/or Threatened Species)	III.B.2.b.	L	NE	NE
Sea Turtles (Protected, Endangered, and/or Threatened Species)	III.B.2.c.	L	NE	NE
Birds	III.B.3.	VL	VL	NE
Sensitive Marine Habitats	III.B.4.	VL	VL	NE
Offshore Habitats and Biota	III.B.5.	L	L	NE

Table III-1. Potential Impact Levels for Structure Removal Activities in the PEA Area (continued)

Resource Category	Corresponding PEA Section	Explosive Structure Removals	Nonexplosive Structure Removals	Leaving Structure In-Place
SOCIOECONOMIC CONSIDERATIONS				
Employment	III.C.1.	VL	VL	VL
Economics	III.C.2.	VL	VL	VL
Onshore Support Facilities, Land Use, and Coastal Communities and Services	III.C.3.	NE	NE	NE
OTHER CONSIDERATIONS				
Commercial Fisheries	III.D.1.a.	L	L	NE
Recreational Fisheries	III.D.1.b.	L	L	NE
Archaeological Resources	III.D.2.	L	L	NE
Military Use/Warning Areas and Explosive Dumping Areas	III.D.3.	VL	NE	L
Navigation and Shipping	III.D.4.	VL	VL	L
Pipelines and Cables	III.D.5.	NE	NE	NE
Other Mineral Resources	III.D.6.	NE	NE	VL
Human Health and Safety	III.D.7.	VL	VL	NE

Potential Impact Levels

NE - No Effect
VL - Very Low
L - Low

A. PHYSICAL ENVIRONMENT

1. Environmental Geology and Geologic Hazards

The soft-bottom-surface sediments of both the Texas and Louisiana shelf and upper slope regions represent a complex array of sediment types in particle size and composition. Description of the surface sediments is compounded by considerable local variation. Visual No. 4 (USDI, MMS, 1986) graphically displays the distribution of surface sediments in terms of the predominant species of particle size and composition. With minor exceptions, mud/sandy mud predominates from the offshore Rio Grande River area on the south to the area offshore of Matagorda County, Texas. Studies by Berryhill and Trippet (1980, 1981a, 1981b) and Berryhill (1984a, 1984b) provide more definitive data on surface sediment composition. The mud/sandy mud zone bifurcates in an eastward direction separated by a sand/muddy sand zone. Offshore Louisiana exhibits a different trend. A nearshore band of sand/muddy sand extends from offshore Cameron Parish to mid-Terrebonne Parish, Louisiana. The midshelf portion of this area is predominated by mud/sandy mud bottom sediments. A second series of studies conducted by Berryhill et al. (1982) provide more detail on bottom sediment characteristics. The remaining portion of offshore Louisiana is predominantly a mud/sandy mud-bottom-sediment regime. A sand/muddy sand zone is found northeast of the delta region in two segments. A coastal segment is separated from a shelf segment by a large primarily north-south finger of mud/sandy mud.

The offshore Mississippi River delta region is characterized by sediment instabilities. Coleman et al. (1980) conducted a subaqueous sediment instabilities study in this area examining, mapping, and characterizing these phenomena. Handley (1980), provided information on the mud slide area in recognition of this geohazard to oil and gas development (both structures and pipelines). Since instabilities may result in mud slumps, flows, and slides, special consideration should be given to this region when explosive means of structure removal are proposed.

There are a series of topographic features interspersed along the Texas and Louisiana OCS shelf and shelf break regions. Many of these are surface expressions of salt diapirs and contain biologically sensitive communities. Impacts of structure-removal operations on these areas are addressed in Section III.B.4. of this PEA.

During structure removals, sediment resuspension in the water column will result. The type of bottom sediment at a removal site is important in determining the levels of turbidity which will occur in the water column. Turbidity impacts are addressed in Section III.A.4. (water quality).

Explosive structure removals in the offshore Mississippi River delta area of sediment instability may initiate mud flows, slumps, or slides in the localized area of the site. If a specific structure removal is proposed in an area of instability, the potential environmental effects of geologic hazards and appropriate mitigation will be addressed in the SEA.

For the rest of the PEA area, geologic conditions are not expected to have an impact on explosive structure removals. Initial structure siting criteria should have examined geologic conditions and potential geohazards. Appropriate structure design or emplacement avoidance criteria will have minimized or eliminated complications from geohazards.

In nonexplosive structure removals or in cases where the structure is left in-place, geohazards are not expected to be a problem.

2. Meteorological Conditions

Humidity, cloudiness, visibility, precipitation, and temperature over the GOM are typical of a maritime climate (USDC, NOAA, 1972). Rainfall averages range from 27.2 in (69 cm) at Brownsville, Texas, to 40.2 in (102 cm) at Galveston, Texas, and to 53.9 in (137 cm) at New Orleans, Louisiana. Cloudiness and poor visibility are more pronounced in the winter season. Occasional dense sea fog may linger near the coast for several days. Dense, persistent fog is most frequent during late winter or early spring in the Louisiana delta region when the Mississippi River runoff reacts with the warmer GOM waters. Hurricanes may also affect the PEA area with one expected at least once every two years (USDC, NOAA, 1978). Visual No. 7, Figure 6E, depicts probabilities of at least one tropical storm per season occurring within the PEA area (USDI, MMS, 1986). Adverse weather conditions are not expected to significantly affect structure removals even though they may delay removal operations for short intervals. Meteorological conditions could have an impact on the alternative of leaving structures in-place. Hurricanes or severe storms could damage these structures, especially if their structural integrity is allowed to deteriorate. With proper maintenance, meteorological impact to an in-place structure is expected to be very low.

3. Physical and Chemical Oceanography

a. Physical Oceanography

Although the PEA area is limited to the Central and Western Planning Areas, the physical oceanographic discussion will encompass the entire GOM. Oceanographic trends and phenomena must be viewed holistically because of the GOM's hydrologic conditions. The GOM is a subtropical sea with an area of approximately 618,000 sq mi (1.6 million sq km). Its continental shelf ranges in width from about 217.5 mi (350 km) offshore West Florida to about 12.4 mi (20 km) off the Mississippi River. The depth of the central abyss ranges to 13,125 ft (4,000 m) (USDI, MMS, 1986). Almost all of the petroleum-related structures are located on the shelf or along the shelf break in water depths less than 1,000 ft (305 m).

The GOM is unique among the world's mediterranean seas, having two entrances: the Yucatan Strait and the Straits of Florida. It also contains a portion of the Gulf Stream system--the parent Loop Current. Along the 15,500 mi (24,940 km) GOM coastline, 21 major estuaries are found on the United States' coast, and a number of rivers--dominated by the Mississippi River--provide sufficient freshwater input so that the basin is classified as a positive estuary.

The Loop Current is a highly variable current feature entering the GOM through the Yucatan Strait and exiting through the Straits of Florida after tracing an arc that may intrude as far north as the Mississippi-Alabama shelf. The Loop consists of ascending and descending 18.6 mi (30 km) wide bands of rapidly moving water enclosing a relatively quiescent inner region. The entire feature may clearly be seen in hydrographic sections down to about 3,281 ft (1,000 m). Below that level there is evidence of a counter-current. Velocities up to 9.8 ft/sec (300 cm/sec) have been measured, but a range of 3.3-6.6 ft/sec (100-200 cm/sec) is probably representative (USDI, MMS, 1986).

The "location" of the Loop Current is highly variable. Visual No. 7 (USDI, MMS, 1986) depicts data regarding the Loop Current and its probabilities of intrusion into the northern GOM. The Loop sheds some anticyclonic eddies when the current is greatly extended which ultimately alters the dimensions of the Loop. Major Loop Current eddies have diameters of 186-249 mi (300-400 km). The eddies may move at speeds of approximately 3.1 mi/day (5 km/day). The life cycle of an individual eddy is approximately one year (USDI, MMS, 1986).

The eddy-shedding behavior of the Loop is the principal mechanism coupling the circulation patterns of the eastern and western portions of the basin. The heat and salt budgets of the GOM are dependent on this importation, balanced by seasonal cooling and freshwater riverine inputs and probably by internal, deeper currents. The eddies are frequently observed to affect local current patterns along the Louisiana/Texas slope, the areas' hydrographic properties, and possibly the biota of fixed structures. There is some evidence that these large reservoirs of warm water play some role in strengthening tropical cyclones when their paths coincide.

Smaller anticyclonic eddies have been observed to be generated by the Loop Current, although it is not known if the process is merely a scaled-down version of the larger cycle. They have diameters on the order of 62 mi (100 km), but the few data available indicate a shallow hydrographic signature on the order of 656 ft (200 m) (USDI, MMS, 1986). Their observed movements indicate a tendency to translate westward along the Louisiana/Texas slope. Similar in size, cyclonic eddies have been observed along the Louisiana/Texas slope. Their genesis and role in the overall GOM circulation are not well studied. A major cyclonic eddy seems to be resident in the southwestern GOM, based on older data synthesis, but some recent evidence points toward a more complex, less homogeneous structure.

Visual No. 7 (USDI, MMS, 1986) depicts a variety of data regarding the physical oceanography of the Gulf of Mexico. The circulation cycle, Loop Current, and Loop Current eddies data, sea surface elevation/mean circulation, variability of surface elevation, winds/storms, and coastal fronts data are all depicted with appropriate references. These data provide a brief overview of the physical oceanographic trends and phenomena in the PEA area. A narrative description of the physical oceanography may be found in Section III-6 of USDI, MMS, (1986).

Physical oceanographic conditions at specific structure-removal sites may vary substantially from the holistic view provided by the data above. Generally, these conditions are not expected to have an impact on structure-removal operations regardless of the methodology employed. The exception to this would be the ability of strong currents at the removal site to transport or disperse sediments resuspended during operations. These impacts are addressed in Section III.A.4. of this PEA. Similarly, the nonremoval alternative is not expected to be impacted by physical oceanographic conditions.

b. Chemical Oceanography

Runoff from approximately two-thirds of the area of the United States and more than one-half the area of Mexico drains into the GOM. This large amount of runoff with its nonoceanic composition is mixed with the surface waters of the GOM and makes the chemistry of parts of the system very different from the open oceanic waters. A narrative overview of the chemical oceanographic trends and phenomena of the PEA area is provided in USDI, MMS (1986).

The CGOM's estuarine and inner shelf area is strongly influenced by the presence of America's major river, the Mississippi, as well as a host of other major drainage systems. Turbidity is normally quite high, with suspended sediments up to 1-10 mg/l, primarily composed of clay minerals (USDI, MMS, 1986). The salinity gradients established in estuarine areas are extremely important for maintenance of finfish and shellfish production. Enormous fluctuations in harvest may occur, paralleling annual hydrologic conditions.

In general, Louisiana's estuaries and nearshore waters are low in salinity and high in nutrient concentrations as compared with those of other states bordering the northern GOM. These characteristics are due primarily to Louisiana's high rainfall and the large volume of river water which makes its way through rich alluvial soils to the GOM. The major contributors of nutrients to the estuaries are the Mississippi and Atchafalaya Rivers.

Within the nearshore area, sediment trace metal values may show high absolute concentrations or anomalous ratios due to the input of contaminated clays borne by the Mississippi River. Transition metals, such as mercury and cadmium, known to be used or disposed of during heavy industrial processes are likely contaminants.

The Mississippi River input acts to create a lens of fresher, more turbid water, often flowing to the west. Hydrographic studies, suspended sediment characteristics, and sensitive chemical analyses demonstrate its influence as far west as South Texas. Nearshore waters may experience a stratifying effect in the water column due to this fresh lens. It is frequently observed during summer months that anoxic bottom water conditions exist on the central Louisiana shelf. Mass mortality of organisms and characteristic chemical changes also occur.

As a probable consequence of the large fluvial input of nutrients, the Louisiana nearshore shelf is considered one of the most productive areas of phytoplankton in the GOM. Integrated chlorophyll values are two times the average GOM values, and integrated production values range an order of magnitude greater than the GOM average.

Less is known about the hydrography and nutrient chemistry of offshore waters in the CGOM area than in other zones. Observations indicate that the effects of the Mississippi are felt here, although much reduced by distance. Anoxic bottom waters may be reported during the summer months, although surface freshening occurs at times of maximal discharge. Upwelling of cooler, nutrient-rich waters onto the shelf is known, but the mechanism is not fully understood since regional circulation patterns remain unclear. The passage of detached, anticyclonic eddies toward the west may be important in this regard. The water column is frequently observed to contain turbid layers associated with interfaces between two or three distinct water layers. A Mississippi River origin is suggested for these layers.

Little is also known about the primary productivity of this offshore region. It is believed that values for productivity and chlorophyll approach GOM averages, but that circulation events, such as the transient effects of passing eddies, might play a role in enhancing these productivity values.

By comparison, the WGOM's estuarine and inner shelf waters contain nutrient concentrations generally representative of open GOM surface waters. Continental runoff, especially during the spring, influences the nearshore surface nutrient concentrations. Nutrients are reduced to extremely low values after spring and summer blooms, but are replenished in the fall.

Chlorophyll is highly correlated with salinity decreases in this area, indicating the influence of riverine input. The local input from Texas rivers is the major source of freshwater nutrients and turbidity in the region. These effects decrease with distance from shore. Most chlorophyll is found at the bottom of the water column, from the shore out to midshelf.

Beyond the nearshore region of heavy influence by Texas rivers, the hydrography and nutrient chemistry of the outer shelf and slope experience the effects of the Mississippi River. Although salinity variations respond to Mississippi River input, nutrients do not correspond as closely, due perhaps to some depletion during transit. Overall, the nutrient values for the outer shelf and slope are somewhat lower than inshore values. The intrusion of nutrient-rich, oxygen-poor water from apparent depths of 656-984 ft (200-300 m) is indicated in many cases, with effects seen all the way up to 230 ft (70 m) depth. An area of major upwelling has been indicated along the shelf break.

Productivity on the outer shelf exhibits much less variability, which can be ascribed to riverine input. Chlorophyll values in this area average less than inshore areas, but an inverse relation with salinity is not found. Aperiodic upwelling events are probably of primary importance in regulating offshore production in this area.

Throughout the PEA area, bottom nepheloid layers may be observed. These layers may be associated with resuspension by swift-flowing bottom currents, with intense at-depth biological activity, or with a complex combination of both factors. Nepheloid layers appear to occur naturally at nearly all locations on the shelf and upper slope environments.

Like the physical oceanographic conditions, chemical oceanographic parameters at specific structure-removal sites may vary substantially from this discussion. The total impacts to the chemical oceanographic trends in the PEA area from both explosive and nonexplosive structure removals is expected to be very low. Only localized areas may be temporarily impacted through resuspension of bottom materials that may contain nutrients or other components. A discussion of these localized impacts may be found in Section III.A.4. (water quality) of this PEA.

The chemical oceanographic trends in the PEA area are not expected to be affected by the alternative of leaving a structure in-place.

4. Water Quality

Water quality in the PEA area is based upon numerous factors, including currents, freshwater inputs, nature and number of discharges, outfalls, and human activities such as municipal and industrial waste discharges, runoff, oil spillage, dredging, etc. In the past, water quality has been defined as the degree to which chemical concentrations and physical parameters within a water mass approach the ambient water state. Coastal and nearshore water quality varies within the PEA area and is determined by river outflows into the GOM. The Mississippi River has the greatest impact on the water quality and is the most significant source of pollution to the PEA area. This river drains approximately two-thirds of the land of the continental United States. Offshore water quality degradation in the GOM may be associated with effluent discharges by current offshore enterprises, including OCS oil and gas extraction activities and marine transportation sources. Refer to Section III.A.5. of USDI, MMS (1986) for detailed information on water quality.

The natural condition of seawater may be altered in several ways during structure-removal activities. Resuspension of bottom sediments, and solid, liquid, and gaseous discharges would be generated by removal and transportation operations.

Impacts resulting from resuspension of bottom sediments following both explosive and nonexplosive structure removals include increased water turbidity and mobilization of sediments containing hydrocarbon extraction waste (drill mud, cuttings, etc.) in the water column. The magnitude and extent of any turbidity increases would depend on the hydrographic parameters of the area, nature and duration of the activity, and size and composition of the bottom material. Increased turbidity would temporarily impact photic processes of the biota at the removal site and reduce primary productivity. The potential effects of mobilizing sediments with the drilling and production waste could also impact the localized marine environment, depending on the quantities of sediment disturbed, the remaining constituents from the drilling and development operations, local hydrographic effects, and the biota of the immediate area (USDI, MMS, 1984).

The physical fates and biological effects of drilling discharges have undergone significant study. The National Academy of Sciences (1983) IMCO et al. (1969), Neff (1981), Petrazzuolo (1981), Menzie (1984), Ecomar, Inc. (1980), and Zingula (1975) have all contributed to the overall knowledge in this area. Additionally, a symposium and workshop have been held to discuss the fates and effects (Symposium, 1980) and fluid transport of drilling fluids (Workshop, 1983). The overall impacts to water quality from resuspension of hydrocarbon extraction wastes is expected to be temporary and limited in scope to the immediate, localized structure-removal sites.

The second area of potential impacts to water quality may be in the explosive by-products generated upon detonation of charges to sever a structure's legs/pilings. Explosion by-products may be gaseous, liquid, or solid, and some of these components may be soluble in water. A brief description of these by-products may be found in Section III.A.5. of this PEA. In the case of a water surface burst (for scare charges), virtually all of the by-products become airborne. Even during very deep explosions, however, most of the gaseous by-products are ejected into the air. Explosive by-products that remain in the water column should be dispersed so rapidly that water quality in the localized area is not expected to be seriously affected.

Debris and bilge water may be released into OCS waters from derrick barges, vessels, crew boats, tugs, and service and supply boats used during structure-removal operations. Discharges should be similar to amounts released by other types of oil and gas industry vessels. Garbage and sanitary waste would also be produced on those vessels with crew quarters and are usually disposed of onshore at an approved site (U.S. Dept. of the Army, COE, 1984).

The major liquid and solid waste impacts from the use of vessels are accidental spills or leakage of fuel oil and lubricants. Oil spills or accidents involving crew boats, derrick barges, supply boats, and similar craft could lead to possible water degradation. The largest proportions of this spilled oil would evaporate. Refer to Section IV.B. of USDI, MMS (1986) for a discussion of oil spill impacts.

Overall impacts of structure removals on water quality in the PEA area are expected to be low. Turbidity would be introduced into the water column as a result of bottom disturbing activities associated with both explosive and non-explosive structure removal. Since structure-removal activities are short term in duration, turbidity plumes would disperse upon completion of these activities and impacts are expected to be very low. See Section III.B.4. of this PEA for a discussion of turbidity impacts on sensitive marine habitats. Explosive by-products would be produced when structures are removed with explosives. Even in very deep underwater explosions, most of the gaseous by-products are ejected into the air. Explosive by-products remaining in the water column would be rapidly dispersed upon detonation, making the expected impact of these by-products very low. Finally, discharges from crew boats, derrick barges, supply boats, or similar craft utilized in both explosive and nonexplosive structure removals could occur. Amounts of these discharges would be similar to discharges released by other vessels utilized in the oil and gas industry. Since structure removals are generally short-term activities, the impact of the discharges on water quality is expected to be low. The alternative of leaving structures in-place is not expected to impact water quality.

5. Air Quality

Gaseous emissions would be generated during structure-removal activities by transportation, onshore and offshore operations, and by explosions. The quality of the air where structure removals are conducted could be degraded by exhaust emissions of the work barge, crew boats, aircraft, and the air emissions from the detonation of explosive charges. When structure-removal operations require the use of explosives, the detonation by-products will vary, depending on the type of explosive used. However, it is expected that the following chemical by-products will be formed: carbon dioxide (CO_2), carbon monoxide (CO), nitrogen (N_2), hydrogen (H_2), and ammonia (NH_3). All of these by-products are in a gaseous form following detonation, and most are expelled to the surface and into the surrounding air column. The majority of the other by-products expected are solid carbon (C) and, in very small percentages, toxic or nontoxic hydrocarbons. In shallow explosions most of these by-products are introduced into the air. In very deep explosions (relative to charge size), most are retained in the water column (O'Keeffe and Young, 1984). Marine and helicopter traffic operating out of established onshore bases also add small amounts of emissions which could impact onshore air quality. Refer to Table III-2 for emission rates typically generated by structure-removal activities.

As shown in Table III-2, the anticipated gaseous emissions from a typical structure-removal operation are relatively small. The impacts to both onshore and offshore air quality from transportation and operations, and from explosive detonations are expected to be very low. When nonexplosive structure-removal methods are used, very low impacts would also be expected. The alternative of leaving a structure in-place would have no expected impacts on air quality.

B. BIOLOGICAL ENVIRONMENT

1. Coastal Habitats

The following habitats are characteristic of the coastal areas in the PEA area: forested wetlands, nonforested wetlands, mangroves, barrier bays, seagrass beds, and barrier beaches and islands. Sufficient infrastructure has been developed within the PEA area to handle all anticipated structure removals on a continuous basis. This includes salvage yards, onshore support bases for vessels and barges, heliports, etc. The low number of vessel and helicopter trips required to a structure-removal site constitutes a very small percentage of the daily traffic on the OCS for hydrocarbon exploration and extraction activities. An in-depth description of the coastal habitats and impacts on these habitats in the GOM may be found in USDI, MMS (1986).

With the exception of onshore threatened and endangered species, structure-removal activities are not expected to impact the coastal environment. Section III.B.2.a. provides a discussion of this matter and offers appropriate mitigation. The alternative of leaving a structure in-place is not expected to have an impact on coastal habitats.

2. Protected, Endangered, and/or Threatened Species

Structure removals have a potential of impacting one onshore group and two offshore groups of animals that are listed by the Federal Government as protected, endangered, and/or threatened. These groups will be discussed in the following sections.

TABLE III-2

Gaseous Emissions Typically Generated by Onshore and Offshore Operations for a Structure Removal

Pollutant	Maximum Emission Rate in pounds per day[1]	
	Onshore	Offshore
Nitrogen Oxides (NO_x)	11.09	1,320
Carbon Monoxide (CO)	24.06	348
Volatile Organic Compounds (VOC)	2.55	38
Total Suspended Particulates (TSP)	1.57	127
Sulfur Dioxide (SO_2)	1.29	375

[1] Maximum expected for one day using 100 lbs (45.4 kg) of explosive material. Calculations are based on a listing of explosive by-products (O'Keeffe and Young, 1984) and from typical emissions obtained from the USEPA publication AP-42, "Compilation of Air Pollutant Emission Factors," Fourth Edition (USEPA, 1986).

a. Birds

A potential impact may involve onshore endangered bird species within the PEA area. The whooping crane's critical habitat includes the Blackjack Peninsula, San Antonio Bay, Mosquito Point, a portion of Matagorda Island between Pringle Lake and Cedar Bayou, and the northern portion of San Jose Island, Texas. Mitigation measures apply throughout the period of October 15 through April 15 each year. Both fixed-wing and rotary-wing aircraft would be prohibited from flying at elevations lower than 500 ft (152 m) and 1,000 ft (305 m), respectively. Brown pelicans may also be impacted if transportation operations utilize Aransas or Cavello Passes. The brown pelican's nesting areas could be disturbed on Sundown Island in Matagorda Bay, Second Chain of Islands in San Antonio Bay, Long Reef in Aransas County, and Pelican Island in Nueces County, Texas. Lessees/operators should provide data regarding the transportation routes, both air and surface means, if support facilities are located in proximity to the previously described areas. Visual No. 2 (USDI, MMS, 1986) graphically depicts these and other threatened and endangered species habitat areas. If a specific structure removal has a potential to impact onshore endangered species, it will be addressed in the SEA. Appropriate mitigation in these SEAs will assure that structure-removal operations would not impact threatened and endangered birds and their habitats. Likewise, the nonremoval alternative would not impact threatened and endangered birds.

b. Marine Mammals

Some 31 species of marine mammals occur throughout the GOM (Shew et al., 1981). With the exception of the manatee, all are whales or porpoises. Several species of whales are protected by the Endangered Species Act, and all marine mammals are protected under the Marine Mammal Protection Act of 1972. The five Federally listed endangered whales found in the GOM are the fin, humpback, right, sei, and sperm whales. These species rarely occur in the PEA area. Similarly, manatees are extremely rare along the central and western Gulf coasts. Their affinity for areas close to the shoreline make it highly unlikely that manatees would be impacted by structure-removal operations. In contrast, the most commonly observed marine mammal in the GOM is the bottlenose dolphin. Other porpoises commonly sighted are spotted, striped, and spinner dolphins. Short-finned pilot and pygmy sperm whales are common to deeper GOM and oceanic water (USDI, MMS, 1985).

It is likely that porpoises could be seen near structure-removal sites. During a previous platform removal on June 21, 1986, in territorial waters near Galveston, Texas, a school of 14 to 17 porpoises was observed near the platform during removal operations. While no direct information is available, marine mammals are thought to be quite sensitive to impacts from underwater explosions (O'Keeffe and Young, 1984). They are especially vulnerable to injury by hemorrhaging in and around the lungs and excitation of small gas bubbles normally present in the intestines. Large marine mammals are less subject to injury than smaller ones, but position in the water column is also a factor in the injuries that an animal might sustain. While no "safe range" estimates are available for marine mammals for the charge size typically used to sever structure legs or pilings, it is obvious that if they are close enough to a proposed structure removal during charge detonation, marine mammals could be injured or killed. The lessee/operator will be required not to detonate main charges if marine mammals are observed in the vicinity. This mitigation would minimize the chances that a structure removal which utilized explosives would harm marine mammals. The use of shaped charges or other methodologies for reducing the blast effects from underwater, subsurface detonations would reduce the possibility of marine mammals being injured or killed during structure-removal operations. The use of nonexplosive methodologies for structure removal or the alternative of leaving the structure in-place would virtually eliminate this possibility.

MMS is currently evaluating and proposing several studies to increase the level of knowledge regarding structure-removal activities and the potential impacts to biota proximal to underwater, subsurface explosions. Data from these proposed studies are designed to be transferable to mitigation measures that would result in reducing the risk of harming protected, endangered, and/or threatened species. Some of the proposed studies are projected to begin their investigative efforts in fiscal year 1987.

With the application of appropriate and effective mitigation measures, the impacts of structure removals on marine mammals are expected to be low. Specific information for individual structure removals on marine mammals and mitigative measures for their protection will be addressed in the SEAs.

c. Sea Turtles

Five species of sea turtles are found in central and western GOM waters. All are protected under the Endangered Species Act. Loggerheads and green turtles are listed as threatened under Federal law; leatherback, hawksbill, and Kemp's ridley turtles are listed as endangered (Shew et al., 1981). Raymond (1986) characterized sea turtle populations as low with a generally wide distribution in the PEA area. While the presence of sea turtles around structures has been documented, little is known to indicate if they commonly utilize the artificial reef environment offered by petroleum structures.

If a sea turtle is present at a structure during removal by explosives, it could be injured or killed. This was demonstrated by Dr. Ed Klima of the NMFS during a previous platform removal. Dr. Klima placed eight sea turtles at distances varying from approximately 200 yd (183 m) to 2,000 yd (1,829 m) from the blast. Four 50-lb (23 kg) charges of sensitized nitromethane were simultaneously detonated approximately 15 ft (5 m) below the seafloor. Injuries were observed in turtles out to 1,000 yd (914 m) from the blast.

Lessee/operator will be required not to detonate main charges if sea turtles are observed in the vicinity. This mitigation would greatly reduce the chances that sea turtles would be impacted by structure-removal activities. Structure-removal methodologies that reduce the blast effects generated by underwater, subsurface explosions may reduce the chance of sea turtles being injured or killed. Nonexplosive structure removals and the alternative of leaving structures in-place would eliminate such a possibility.

The application of appropriate and effective mitigation for the protection of sea turtles during structure removal operations is expected to keep the impacts on these animals low. As stated in the previous section (Section III.B.2.b. of this PEA), proposed MMS studies and knowledge gained in each removal operation will be applied in formulating more effective mitigative steps to further reduce potential impacts.

Further site-specific information on this topic and appropriate mitigation will be discussed for individual structure removals in the SEAs.

3. Birds

Gallaway and Lewbel (1982) provided a description of birds observed at petroleum extraction structures across the central and western GOM. Species such as the black tern and snow goose passed through the GOM waters but did not appear influenced by the presence of the petroleum extraction structures. Terrestrial passerine birds were observed on offshore petroleum-related structures and were all representatives of winter residents along the coast. Fall migratory birds appeared to forage for insects at petroleum-related structures. Gulls, particularly laughing gulls and royal terns, were found to make extensive use of the surrounding waters for nesting and feeding. During a previous structure removal in territorial waters near Galveston, Texas, few birds were observed in the vicinity prior to detonation of explosives. Following the detonation, however, numerous gulls and other birds were observed circling the area and feeding on dead fish at the surface of the water.

The sensitivity of birds to blasts from underwater explosions is described by O'Keeffe and Young (1984). It was found that a 20 psi (1.4 kg/sq cm) airshock was required to produce 50% mortality. This is highly unlikely in the case of an underwater explosion. Even though it is possible that the plume from an underwater blast could strike a bird, the probability of a direct hit is expected to be quite low. It is assumed that scare charges would frighten away any birds in the area prior to the main blast, but further observations will be needed to verify this assumption. To date, observations of structure removals by MMS personnel are in agreement with statements by O'Keeffe and Young. No incidents of injury or mortality have been noted at structure removals which required the use of explosives.

While the presence of migratory bird species and seasonally present bird life were noted at petroleum-related structures, marine bird species such as gulls and terns appeared to make the most extensive use of the habitat offered by offshore petroleum-related structures. Individually, loss of a petroleum-related structure and its associated habitat would not have a significant impact on bird populations. Birds are quite mobile and an abundance of suitable habitat currently exists offshore. Cumulatively, the net loss of a great many petroleum-related structures is expected to have a very low impact on selected populations of bird species. However, these species existed successfully before the introduction of offshore oil and gas structures.

Removal of structures by both explosive and nonexplosive methodologies has not and is not expected to have a significant impact on bird populations. Cumulatively, the loss of structures as habitat is estimated to have a very low impact on selected bird species. No data are available to indicate if leaving structures in-place would significantly impact (or enhance) bird populations in the PEA area.

4. Sensitive Marine Habitats

For purposes of this PEA, sensitive marine habitats are 41 topographic features in the PEA area that harbor corals or coral-community organisms. These are fully described and discussed in USDI, MMS (1986). Additional information regarding these communities may be found in Bright and Rezak (1978), Rezak and Bright (1981) and Rezak et al. (1983, 1985).

These valuable and sensitive areas may be adversely impacted by routine oil and gas exploration and development activities (USDI, MMS, 1986). Consequently, No Activity Zones have been established by lease stipulation for these areas which prohibit such activities as the emplacement of structures on the sensitive marine habitats. Therefore, no structure-removal activities will occur within the No Activity Zones.

Structure removals immediately outside the No Activity Zones may have the potential to impact sensitive marine habitats. Both explosive and nonexplosive removal operations will disturb the seafloor and resuspend sediments in the water column, resulting in turbidity. Explosive methodologies are thought to create more turbidity than nonexplosive methods, but this turbidity is not considered to be a problem because it will be dispersed by currents. It has been shown that currents sweep around topographic features rather than up and over them (Rezak et al., 1985). If small amounts of sediment should reach the sensitive biota on a bank, the same currents which maintain the banks free of fine material will remove any deposited material. Thus, turbidity resulting from structure-removal activities is expected to have very low impacts on the biota of sensitive marine habitats.

Blast effects from explosive structure removals immediately outside the No Activity Zones may impact sensitive marine habitats and the resident biota. A discussion of blast impacts to marine life will be discussed in Section III.B.5. of this PEA. It appears that coral and other sessile invertebrates and benthic organisms which characterize the biota of sensitive marine habitats are fairly resistant to shock (O'Keeffe and Young, 1984). The No Activity Zone also provides spatial separation to the biota of sensitive marine habitats. Impacts to these areas and their biota from explosive structure removals are expected to be low.

The alternative of leaving structures in-place is expected to have no impact on sensitive marine habitats and the resident biota.

5. Offshore Habitats and Biota

Offshore habitats include the water column and the seafloor in the PEA area excluding the sensitive marine habitats. Sediments in the western and central GOM Planning Areas are generally muds with some areas of higher sand content. Descriptions of the benthic habitats in the GOM may be found in USDI, MMS (1986); Berryhill and Trippett (1981a and 1981b); Darnell et al. (1983); and Pequegnat (1983). The continental shelf consists of large areas of different habitats. These areas are so extensive that oil and gas operations, including structure removals, would have little if any impact on communities, populations, or species.

The U.S. Department of Commerce, NOAA (1985) and Darnell et al.(1983) have published atlases showing the general offshore distribution and life history aspects of the most important fishes and other nonendangered marine life found throughout the soft and hard bottom areas of the PEA area. Included in these atlases are approximately 50 species of greatest interest to man for food and recreation. They spend a large portion of their adult lives in and around the discovered oil and gas fields of the PEA area.

Offshore structures become unique habitats in their own right (Gallaway and Lewbel, 1982). Structures provide habitat for species that would not normally be found there were it not for the solid substrate that structures offer. Upon installation into marine waters, structures are rapidly colonized by a diverse array of microorganisms, algae, and sessile invertebrates including shelled forms (barnacles, oysters, mussels, etc.), as well as soft (bryozoans, hydroids, sponges, and octocorals) and hard (corals) encrusting, colonial forms. The organisms that attach and grow on the structures provide habitat and/or food for many motile invertebrates and fishes, particularly brittle stars, amphipods, small crabs and shrimps, and blennies. Gallaway and Lewbel refer to the sessile forms and dependent motile forms collectively as "the biofouling community." In addition, diverse assemblages of large pelagic and demersal fishes are found intimately associated with the structures. These fishes are often represented by tremendous numbers of individuals; some of the species are of direct economic and recreational interest. When comparing the species composition found at different structures across the GOM, Gallaway and Lewbel (1982) found minor differences between those in Louisiana waters and those in Texas waters. For example, the predominant biofouling organism in coastal structures off Texas is the Mediterranean barnacle, while two species of acorn barnacles predominate on the coastal structures off Louisiana. More striking differences were noted, however, as a function of water depths. Gallaway and Lewbel (1982) described three zones: coastal, offshore, and blue water. While barnacles are the predominant biofouling organism in the coastal structure zone, pelecypods become dominant in the offshore structure zone (barnacles are still well represented in the near surface zones on the structures). The blue water structure zone is predominated by algal mats and stalked barnacles at the surface with hydroids and pelecypods predominating in the deeper zones. Biomass (per unit area) is highest on structures in the shallow coastal waters and lowest on those in the deeper waters of the blue water zone.

Oil and gas structures in the PEA area serve as aggregation points for huge numbers of fish representing many species. In the most general sense, the fishes can be classified as either transients or residents. Fish which are trophically independent of structures often are responsible for most fish biomass around production structures (Gallaway and Lewbel, 1982). Such fish as the Atlantic spadefish and red snapper are examples of fish which are independent of structures. Sheepshead and blennies are examples of resident species which appear trophically dependent upon the biofouling community of the structures for food and/or cover. Barracudas, certain jacks and sharks, cobia, bluefish, and various mackerels are examples of large predators which do not appear to be residents around oil and gas structures, but rather are believed highly transient. Around a given structure, bluefish have been seen in schools of up to about 5,000 individuals, but they do not feed much on the resident species, given the slow recruitment of most of the resident species and their relative seasonal constancy in terms of population levels.

Reef fishes such as snappers, groupers, and amberjack; groundfish, especially Atlantic Croaker, sand and silver seatrout; and pelagics such as mackerels and cobia are known to concentrate in large numbers around the petroleum structures of the PEA area (Ditton and Auyong, 1984). Other studies, such as those by Gallaway et al. (1981) and Continental Shelf Associates, Inc. (1982), showed that shallow and deep water structures off Louisiana harbor large populations of Atlantic spadefish, blue runner, sheepshead, jacks, and other fishes.

Both explosive and nonexplosive structure-removal operations would impact the organisms associated with an individual structure. Nonexplosive removals would result in the death of sessile organisms attached directly to the structure and would displace motile forms of life to other structures or hard bottom areas nearby (if these were available). Explosive structure removals would kill more organisms because of the blast effects produced by the detonation of removal charges.

O'Keeffe and Young (1984) have described the impacts of underwater explosions on various forms of sea life. Most of their data, however, were derived from open water explosions of a much larger size than those used in typical structure-removal operations. They found that sessile organisms of the benthos, such as barnacles and oysters and many motile forms of life (such as shrimp and crabs) which do not possess swim bladders, are remarkably resistant to the blast effects from underwater explosions. Many of these organisms which are not in the immediate blast area would survive. Data from underwater explosive tests indicate that oysters exposed to the detonation of 300 lb (135 kg) charges in open water showed only 5% mortalities at distances of 25 ft (8 m). Crabs exposed to 30 lb (14 kg) charges of explosives in open water showed 90% mortalities at 25 ft (8 m) but very few died at 150 ft (46 m). These authors also noted "...no damage to other invertebrates such as sea anemones, polychaete worms, isopods, and amphipods." Benthic organisms appear to be further protected from the impacts of explosive detonations by the very rapid attenuations of the underwater shock wave through the seabed enroute to the benthic communities. Theoretical predictions suggest that the shock waves of explosives set 16 ft (5 m) below the seabed as required by MMS regulations would further attenuate blast effects. Furthermore, charges used in OCS structure removals are typically much smaller than those cited by O'Keeffe and Young.

Data presented by O'Keeffe and Young (1984) indicate that fish would be more vulnerable than other motile and nonmotile benthic organisms during explosive structure removals. The sensitivity of fish to blast impacts varies greatly depending on the size of the fish (small fish are more sensitive), the position in the water column (susceptibility varies with depth), and most importantly, whether a species contains a swim bladder (those which do not are very resistant to blast impacts). Most of the fish which are of recreational and economic importance contain some type of swim bladder. O'Keeffe and Young have constructed tables of "safe ranges" for swim bladder containing fish using open water charges of pentolite. Safe ranges were defined as distances in which 90% of the fish in a given size class could survive the impacts of the underwater detonation. When a 100-lb (45 kg) charge was detonated at a depth of 50 ft (15 m), the safe range for 1-oz (0.03 kg) fish was estimated to be 1,235 ft (376 m). For 1-lb (0.45 kg) fish, this range decreased to 865 ft (264 m). The same conditions yielded a safe range of 590 ft (180 m) for fish in the 30-lb (13.6 kg) class. Moderate fish kills have been observed in recent explosive structure removals in waters off the Louisiana and Texas coasts. The impacts of structure removal on commercial and recreational fishing are addressed in Section III.D.1. of this PEA.

The lethal impacts of underwater blasts can be reduced during structure removals by minimizing the charge sizes. Smaller charges result in reduced blast impacts. Placing the charges deeper than 16 ft (5 m) below the mudline may also decrease the shock wave by attenuating the blast effects to the surrounding bottom sediments. Some structures may be severed by using smaller shaped charges instead of bulk charges. Other potential measures to reduce the impacts of explosive structure removals on marine life are discussed in Sections III.B.2.b. and c. (marine mammals and sea turtles) of this PEA.

The impact to offshore habitat from removing any given structure by explosive or nonexplosive means is expected to be very low. Gallaway and Lewbel (1982) estimated that structures in the GOM provided some 3,957 ac (1,583 ha) of artificial reef habitat. A typical structure may provide 0.5 to 2.0 ac (0.2 to 0.8 ha) of habitat depending on the depth and configuration of the structure. Cumulatively, the net loss of many structures could become more significant. The artificial reef habitat provided by structures comprises 28% of the known hard bottom habitat in the PEA area. At present, new structures are being placed in the PEA area while others are being scheduled for abandonment and removal. As oil and gas resources become depleted, certain areas will suffer a net loss of structures and a reduction in their related habitat benefits. The creation of artificial reef sites could be implemented to offset the impact of structure removals in areas where these losses are most noticeably felt. A discussion of artificial reef programs is contained in Section III.D.1.b. of this PEA.

Nonexplosive structure-removal operations are expected to have a very low impact on offshore habitats and biota. The effects would be localized to the habitat and biota associated with the individual structure. Explosive structure removals are expected to have a slightly higher impact. Sessile and motile benthic organisms are resistant to shock wave impacts, but fish with swim bladders in proximity to the blast could be injured or killed. Other impacts from explosive detonations are also localized at the individual structure. The overall impact of explosive structure removals to offshore habitats and biota is expected to be low. The most significant impact on offshore habitat and biota is the cumulative loss of artificial reef habitat from both explosive and nonexplosive structure removals. This impact is expected to remain low as long as new structures are being placed in the PEA area and a successful artificial reef program would retain these valuable habitats.

C. SOCIOECONOMIC CONCERNS

1. Employment

Information regarding employment related to structure-removal operations was compiled through conversations with knowledgeable sources within the industry (Debaillon, 1987; Gresham, 1987; and Moore, 1987). It was determined that several major salvage companies perform structure-removal operations. These companies all have derrick barges which possess sizable lift capacity. In addition, numerous smaller companies are involved in the removal of smaller structures or provide speciality services such as diving, explosives, or welding expertise to the major salvage companies. It appears that the major salvage companies employ approximately 600 persons who are associated with structure removals in the PEA area. While employment figures were not available for the smaller salvage or specialty companies, the number of persons employed directly by structure-removal operations is estimated to be less than 1,500 people.

The number of people deployed on any given structure removal can vary depending on such factors as structure location, water depth, size and type of structure, and the removal method employed. A typical platform-removal operation at 100 ft (30 m) water depths would require approximately 117 people. A functional breakdown of these positions is shown on Table III-3.

Information on employment across the central and western GOM is discussed in USDI, MMS (1986). Since structure-removal operations are transitory in nature, few new employment opportunities would be generated in coastal communities adjacent to individual removal sites. Workers employed in structure-removal operations live across the central and western Gulf coast. Upon completion of a structure removal, the workers return to their places of residence. Structure-removal operations utilize onshore businesses that provide such services as marine fuel, food supplies, marine vessel parts, and maintenance. This utilization generates few jobs because the marine service and supply infrastructure along the Gulf Coast is so well developed from other oil and gas activities.

USDI, MMS (1986) states that 76,600 jobs in the central and western GOM are generated either directly or indirectly from offshore oil and gas production. Employment in structure-removal operations represents less than 2% of this total. Therefore, both explosive and nonexplosive structure removals are expected to have a very low impact on overall employment across the Gulf Coast. Similarly,

Table III-3

Crew Breakdown for a Typical Platform-Removal Operation

Job Type	Number of Persons
Derrick Barge Personnel	50 to 60
Tug Boat Crew (2 tug boats for derrick and material barges)	15
Diving Crew	8
Explosives Technician and Helper (if utilized)	2
Mechanical Cutting Personnel (if utilized)	6 to 10
Oil Company Representatives	2 to 4
Scrap Processing Personnel (onshore)	15 to 20
Total	92 to 117

Sources: Debaillon, 1987; Gresham, 1987; and Moore, 1987.

the alternative of leaving structures in-place is expected to have a very low impact on overall employment. However, employment within affected companies could be heavily impacted if all structures were left in-place. Explosives contractors are expected to experience adverse economic impacts by a decision to exclusively utilize nonexplosive structure-removal methods.

2. Economics

Information regarding the costs of structure removals was obtained by discussions with Mr. Paul Janke of Cities Service Oil and Gas Corporation (Janke, 1986). The costs of structure removals are a function of the following: water depth, number of conductors, and structure size and configuration. An example of the current costs to remove a structure in 50 ft (15 m) of water utilizing explosives was approximately $250,000, roughly the costs of installing the structure. Removal costs for larger structures in deeper waters should also approximate installation costs. A general estimate of the costs of nonexplosive structure removals are approximately 20% to 100% greater than explosive methods. A recent example is the removal of a platform with four 60-in (152 cm) diameter by 1 5/8-in (4.1 cm) wall thickness piles in 130 ft (40 m) of water by the underwater arc cutting method. The offshore operator indicated that the expense of this method exceeded the cost of explosive methods by $70,000. Many other factors may also escalate structure-removal costs. Weather and sea conditions may delay operations. Stand-by costs for derrick barges and other support vessels as well as personnel costs may sharply increase removal costs. Difficulties in jetting material out of structure legs or pilings can also cause delays. Grouted templets or well guides may require additional time and costs. Costs may accumulate due to transportation to an onshore support facility for salvage and/or structure reuse.

A discussion of the economics associated with the offshore oil and gas industry can be found in USDI, MMS (1986). The structure-removal component of this total is very small. Approximately 120 structure removals have been projected in 1987. In addition, structure-removal operations do not represent a significant portion of employment along the Gulf Coast. While the structure-removal industry utilizes the onshore support infrastructure, its contribution is relatively small compared to the total contribution of the offshore oil and gas industry. The impacts of structure removals (including explosive and nonexplosive methodologies) on the overall economics of the Gulf Coast are expected to be very low. Similarly, adherence to the alternative of leaving structures in-place is expected to have a very low impact on the overall economics of the coastal region. The economic impacts of this alternative on structure-removal related companies, however, are expected to be high.

3. Onshore Support Facilities, Land Use, and Coastal Communities and Services

Onshore support bases used for structure-removal operations are often the same bases used for structure installation activities and other offshore oil and gas operations. A listing of the major offshore oil and gas support facilities is provided in Table III-4. Information obtained from representatives of several major salvage companies (Deballlon, 1987; Gresham, 1987; Jackson, 1987; and Moore, 1987) indicates that they utilize the following shore-based facilities: Morgan City (Amelia), LA; Houma, LA; Belle Chase, LA; Galveston, TX; Port Aransas, TX; and Green Bayou (Houston Ship Channel), TX. A typical onshore base which would support an offshore structure-removal activity is illustrated in

Table III-4

Major Onshore Support Facilities

Coastal Subarea

Texas

- -Ingleside/Port Aransas/Harbor Island/Rockport (Corpus Christi Area-San Patricio, and Aransas Counties)
- -Port O'Connor (Calhoun County)
- -Freeport (Brazoria County)
- -Galveston/Pelican Island (Galveston County)
- -Sabine Pass (Jefferson County)

Louisiana

- -Cameron (Cameron Parish)
- -Grand Chenier (Cameron Parish)
- -Intracoastal City (Vermilion Parish)
- -Morgan City/Amelia (St. Mary Parish)
- -Lafayette (Lafayette Parish)
- -Houma (Terrebonne Parish)
- -Dulac (Terrebonne Parish)
- -Leeville (Lafourche Parish)
- -Port Fourchon (Lafourche Parish)
- -Grand Isle (Jefferson Parish)
- -Venice (Plaquemines Parish)

Mississippi

- -No major facilities at present

Alabama

- -Mobile/Bayou LaBatre/Theodore (Mobile County)

Source: USDI, MMS, 1986.

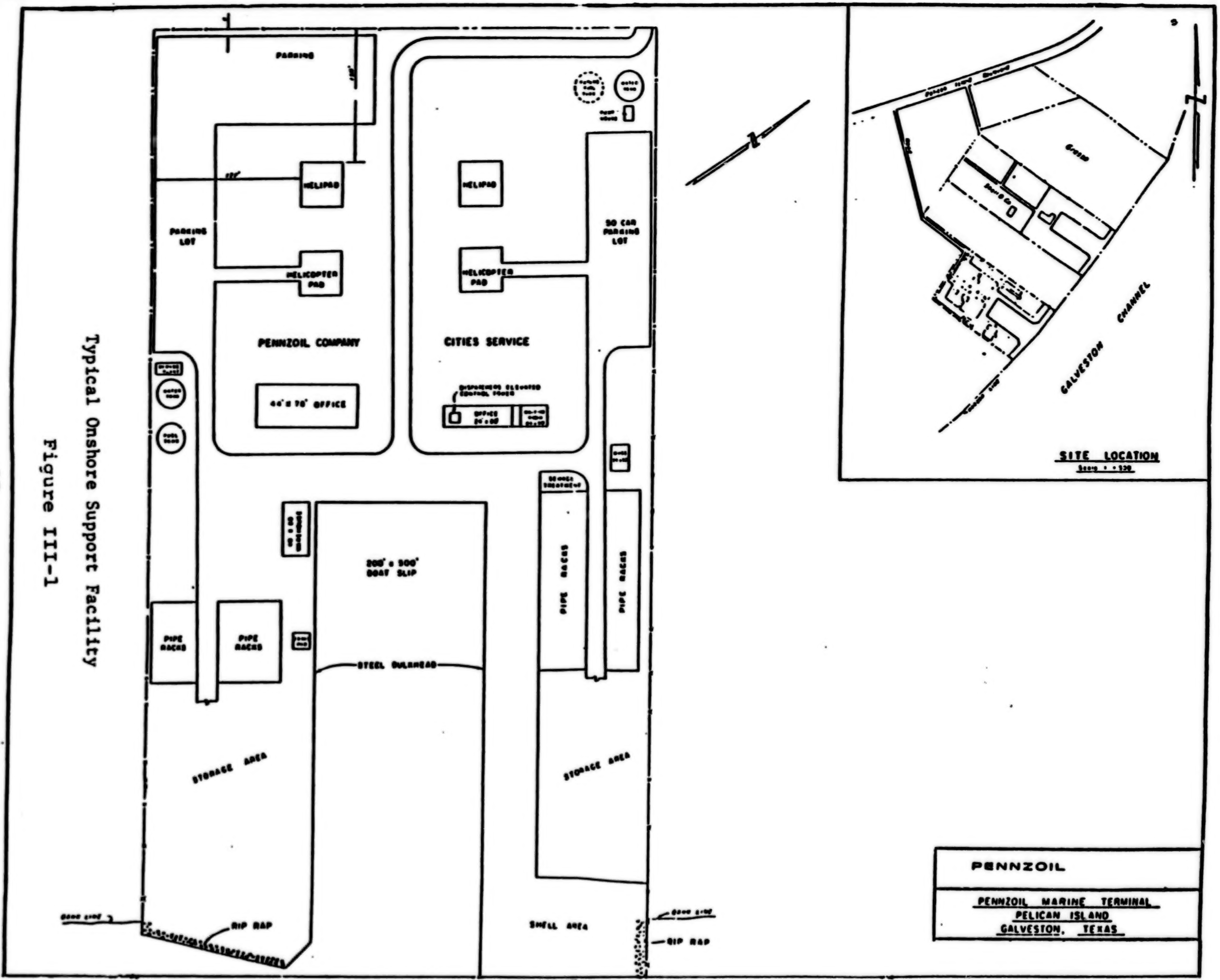
Figure III-1. The illustrated base, located on Pelican Island, Galveston, Texas, recently supported the offshore removal of Platform B-1 on Galveston Area, Block 144, Lease OCS-G 3374 by Cities Service Oil and Gas Corporation (Janke, 1986).

An onshore support facility usually includes dock, office, warehouse, mobile crane, storage tanks, heliport, parking area, and road access. The established onshore facilities are accustomed to high levels of air and vessel traffic in support of other oil and gas operations; therefore, structure-removal activities are not expected to significantly impact traffic levels or change the usage pattern of these facilities. Similarly, the nonremoval alternative is not expected to significantly impact shore base usage or traffic.

For a description of land usage and major onshore activities in the coastal areas of the central and western GOM, see USDI, MMS (1986). Since structure-removal activities currently utilize existing onshore support facilities and existing service and supply industries, they are not anticipated to result in the construction of new onshore support facilities or industrial facilities. Similarly, significant expansion of existing facilities is not anticipated. Land uses in the coastal region of the PEA area are not expected to be significantly altered as a result of structure-removal activities.

For a description of coastal communities and populations of the central and western GOM, see USDI, MMS (1986). Personnel engaged in structure-removal activities live throughout the central and western Gulf Coast (Debaillon, 1987). They typically are quartered onsite during structure removals and return to their residences upon completion of the job. Structure-removal activities are not expected to have a significant impact on coastal communities or community services.

Structure-removal operations, utilizing both explosive and nonexplosive methodologies, are not expected to significantly impact onshore support base usage, land use, or coastal communities. Similarly, these factors are not expected to be significantly impacted by the alternative of leaving structures in-place.



Typical Onshore Support Facility

Figure III-1

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D. OTHER CONSIDERATIONS

1. Commercial and Recreational Fisheries

Nearly all fish species significantly contributing to the GOM's commercial and recreational catches are estuarine dependent. Most leave the estuaries as juveniles or subadults and spawn at sea after becoming mature, reproductive adults. The eggs of the majority of these species hatch in the waters of the open GOM, and the developing larvae become part of the offshore planktonic community. Under the influence of tides, currents, and winds, the young eventually arrive at the estuarine nursery grounds where they feed, grow, and mature prior to migrating out to sea to repeat the spawning process. A discussion of the organisms found in the offshore environment and the impacts of structure removals on these organisms can be found in Section III.B.5. of this PEA.

a. Commercial Fisheries

Characteristic fishes are associated with the various GOM marine environments. Toward the middle shelf, the number of sciaenids (croaker family) is dramatically reduced when compared to the nearshore waters (sciaenids are a major fish component of the territorial waters). The midshelf fish community is composed primarily of small flounders and searobins. The offshore reefs (including platforms and caissons) support such fishes as snappers and seabasses, while oceanic fishes such as the bluefin tuna and broadbill swordfish inhabit the offshore open ocean waters (USDC, NMFS, 1979).

Penaeids (brown, white, and pink shrimp) constitute the most economically important fishery in the PEA area. Brown shrimp are centered in the northwestern GOM while white shrimp are centered on the mud and sand bottoms off the coast of Louisiana. Pink shrimp have a noncontinuous (patchy) distribution across the OCS (Darnell et al., 1983).

The GOM's menhaden fishery constitutes the largest fishery in terms of pounds landed. Gulf menhaden occur in the shallow waters of the northcentral GOM from western Florida to eastern Texas. About 93% of this fishing effort occurs within 10 mi (16 km) of shore (USDI, MMS, 1986).

An industrial bottomfish trawl fishery exists in the nearshore waters of the northcentral GOM. Approximately 95%-98% of the trawl fishery catch includes croaker, spot, sand seatrout, silver trout, silver eel, catfish, and longspine porgy. Croaker is the largest component of the catch; it prefers a mud bottom. Generally, croakers are not found in water depths exceeding 60 fathoms (110 m).

It is estimated that one structure may remove 3 to 5 ac (1.2 to 2.0 ha) of trawling space. Removal of a structure would restore the areas for trawling but, considering the total area available for commercial trawling operations, this addition would not be significant. Other commercial fishing operations utilize the artificial reef habitat of petroleum structures in the harvest of groupers and snappers; however, the majority of these structures are generally in deep waters.

The artificial habitat offered by oil and gas structures makes them popular destinations for some types of commercial fishermen. The removal of a single structure would not significantly harm these commercial fisheries, particularly if another structure is located nearby. However, if all structures are removed in a localized area, certain commercial fisheries could be substantially impacted. Interest is high throughout the GOM Region to retain selected oil and gas structures in the marine environment as dedicated artificial reefs to enhance marine fisheries when the structures are no longer useful for oil and gas production (USDI, MMS, 1986). An active rigs-to-reefs program would help to offset cumulative structure-removal impacts on commercial fishing. With this mitigation, the overall impacts of structure removals on commercial fishing are expected to be low. The alternative of leaving structures in-place is expected to continue to provide existing benefits to some types of commercial fishing.

b. Recreational Fisheries

Studies and reports by Ditton and Graefe (1978), Dugas et al. (1979), Ditton and Auyong (1984), and Witzig (1986) show that petroleum structures are preferred fishing destination when accessible to offshore fishermen. Furthermore, findings from Witzig (1986) indicate that the majority of the offshore saltwater fishing in Louisiana and Texas takes place in direct association with oil and gas production structures. These findings also indicate that fishermen who fish near petroleum structures catch more fish, bigger fish, and better fish on the average than all other saltwater fishermen. Petroleum structures are such popular and productive fishing locations because they function as artificial reefs. In recognition of this, they have been referred to by the Secretary of the Interior as *de facto* artificial reefs.

Removal of structures eliminates a viable artificial reef and the exceptional recreational fisheries that develop in association with the individual structure sites. Use of underwater explosives in the removal process and their impacts on marine life in proximity to the production structure have been previously discussed in Section III.B.5. The recreational fishery directly associated with production structure sites will be lost or displaced when these structures are removed.

The MMS adopted an artificial reef policy in 1983 in response to public and private interest in using obsolete oil and gas structures for permitted artificial reefs. This policy is designed to "...encourage the conversion of selected obsolete oil and gas structures to artificial reefs on the OCS to enhance recreational and fishing opportunities in accordance with predetermined guidelines and goals." Since adoption of this policy, Congress enacted the National Fishing Enhancement Act of 1984 (Title II of P.L. 98-623) establishing national standards for artificial reef development and calling for the development of a National Artificial Reef Plan. The national plan has now been published (USDC, NMFS, 1985) and encourages states to take the leadership in planning and developing artificial reefs. All GOM States have expressed interest in acquiring retired oil and gas structures for artificial reef development. Several States, including Louisiana, are involved in comprehensive planning to identify specific offshore sites under national standards suitable for artificial reef development with oil and gas structures. When there is an appropriate Corps of Engineers permitted artificial reef site, use of the removed structure as artificial reef material is suitable mitigation to the deleterious effects of structure removals on recreational fishing. Reggio (1987) discusses the possible artificial reef options and their environmental implications. An active artificial reef program would help to offset cumulative impacts of structure removals on recreational fishing. Thus, the overall impacts of structure removals on recreational fishing is expected to be low. The alternative of leaving structures in-place would allow the beneficial effects of these *de facto* artificial reefs to continue as prime recreational fishing locations.

2. Archaeological Resources

MMS is required by the National Historic Preservation Act of 1966, the OCS Lands Act Amendment of 1978, and the National Environmental Policy Act of 1969 to review oil and gas operations on the OCS for the protection of historic and prehistoric archaeological resources. In 1977, a baseline study, Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf (CEI, 1977), was conducted to better determine where significant archaeological resources may occur in the GOM. This study established cultural resource zones of high (zone 1) and low (zone 2) probability for the occurrence of archaeological resources and also served as a baseline study for MMS staff archaeologists, enabling them to assess the likelihood of potential archaeological resources existing at a given site. See USDI, MMS (1986) for a more in-depth discussion of archaeological resources.

Since 1973 (beginning with OCS Lease Number OCS-G 2440), the oil and gas companies have been required to conduct remote sensing surveys and to compile archaeological survey reports to assess the historic and prehistoric archaeological potential for individual lease blocks in areas where archaeological resources are likely to occur. MMS staff archaeologists have reviewed these lease block archaeological reports and have developed mitigative measures based on their analysis. In every case to date, the oil and gas companies have elected to avoid areas within their lease blocks identified as high probability areas for the occurrence of either historic or prehistoric archaeological resources. In the past 13 years, no significant archaeological resources have been impacted by oil and gas operations because development and production structures have been located well away from these resources. Therefore, the proposed removal of any production structures or caissons constructed after 1973 (OCS-G 2440) is not expected to impact either historic or prehistoric archaeological resources.

Prior to 1973, oil and gas lessees were not required to conduct archaeological resource surveys or to compile archaeological survey reports. The Federal Government has conducted oil and gas leasing on the OCS since 1954, and many oil and gas activities were carried out prior to requirements that insured the protection of archaeological resources. These early lease areas tended to be in shallow waters where archaeological resources are most likely to be found; therefore, they have the greatest probability for impacting them. Even in areas of high probability for occurrence of these resources, the original emplacement of the structure would have severely disturbed the seafloor. The probability that structure removals would impact a significant intact archaeological resource is expected to be low.

In areas leased after 1973, structure removals are not expected to impact archaeological resources because the lessees have chosen to locate structures well away from these resources. In areas leased prior to 1973, the original emplacement of the structure severely disturbed the seafloor, causing future structure removals to have a low probability of impacting archaeological resources. The overall impacts of structure removals, regardless of methodologies used, are expected to be low. The nonremoval alternative is expected to have no impact on archaeological resources.

3. Military Use/Warning Areas and Explosive Dumping Areas

Approximately 10% (4 million ac or 1.6 million ha) of water and air space in the CGOM is utilized by various military organizations to conduct training and operational missions in three military warning areas (MWA) and two Eglin Water Test Areas (EWTA) (USDI, MMS, 1986). The Air National Guard uses MWA-453 for training purposes. Similarly, the Naval Air Reserve uses MWA-92 for its training missions. In MWA-155, the Navy conducts carrier maneuvers and carrier pilot training. EWTA 1 and 3 are used for rocket testing and research. For MWA-92 and MWA-453, as well as EWTA 1 and 3, neither the Navy nor the Air Force has indicated intensive utilization of the areas for recent operations. Present interest in oil and gas development within these three areas is low. The Navy, however, has indicated that MWA-155 is under continuous and intensive use. Although MWA-155 has very little oil and gas development within it, the Navy has expressed concern that future oil and gas exploration and development facilities may pose a serious restriction to their operations within this area.

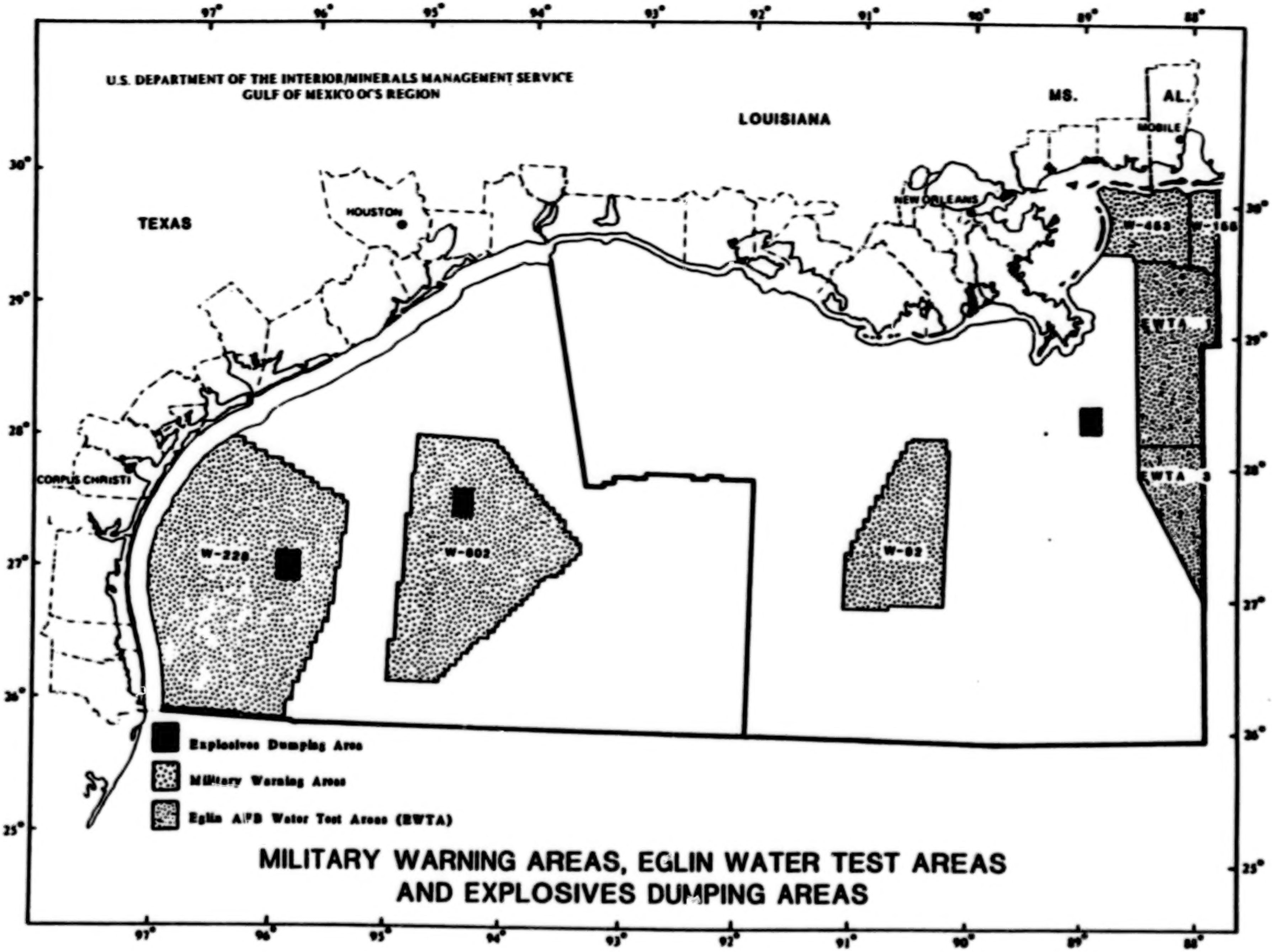
Approximately 37% (12 million ac or 4.9 million ha) of water and air space in the WGOM is utilized by the military for various operations within two MWAs (USDI, MMS, 1986). The Air Force uses MWA-602 extensively for a myriad of training operations that include live firing aerial gunnery, trailing wire antenna activities, flares and special drops/tests, and low-level B-52G flights. These operations impact MWA-602 from the water's surface to an altitude of 45,000 ft (13,716 m). The location of MWA-602 (mostly over deeper waters) has limited oil and gas development to the northern one-third of this area. In contrast, while MWA-228 has been intensively used by the Navy for carrier maneuvers and carrier pilot training, it has also been the site of considerable oil and gas activity and development (USDI, MMS, 1986). Figure III-2 depicts the various MWA, EWTA, and several explosives dumping areas within the PEA area.

Military stipulations have been incorporated into OCS leases since Sale 43 (South Atlantic Region) in March 1978. These stipulations follow a policy of multiple-use and joint coordination between the Department of Defense (DOD) and the USDI and ultimately between specific armed forces base commanders and the lessee(s). The purpose of the military stipulation is to reduce potential impacts, particularly for safety, without reducing or eliminating oil and gas operations in areas where military operations are conducted. The specific wording for the latest military stipulation is found in USDI, MMS, (1986). The stipulation is composed of the following elements: hold and save harmless, electromagnetic emissions, and operational segments. The hold and save harmless segment protects the U.S. Government from liability in the event of an accident involving the lessee and military activities. The electromagnetic emission segment of the stipulation requires the lessee to control these emissions to prevent unacceptable interference to DOD operations within a MWA or EWTA. The operational segment requires the lessee to enter into an agreement with designated military installation commanders to positively control boat and aircraft operations into and through a MWA or EWTA. Notification by the lessee of proposed operations within the area(s) allows coordination with base commanders in scheduling and planning military missions and maneuvers.

Within the PEA area, DOD has conducted ordnance disposal activities. For the large explosive dumping areas shown on Figure III-2, the disposal consisted primarily of old ordnance, unexploded shells, and depth charges. No dumping activities have transpired since 1970 at any of the explosive dumping areas (USDI, MMS, 1986).

For EWTA 1 and 3, an undeterminable amount of unexploded ordnances has been released as a result of the Air Force rocket and missile testing, training, and research missions. The exact locations of this unexploded ordnance cannot be determined.

Mitigation measures, such as the military lease stipulations and shallow hazard surveys, have done much to protect structures from potential hazards. The



MILITARY WARNING AREAS, EGLIN WATER TEST AREAS AND EXPLOSIVES DUMPING AREAS

Figure III-2

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stipulation requires coordination between lessees and military base commanders. Shallow hazard surveys identify not only geohazard conditions but may identify ordnance or other debris that may adversely impact petroleum extraction operations. Lessees may avoid these areas when conducting their exploration and development activities and when emplacing a structure for production. This avoidance is expected to provide a margin of safety during structure-removal activities.

Specific operations for a proposed structure removal within a MWA, EWTA, or explosive dumping area will be assessed in a SEA. If a structure-removal proposal indicates trafficking across a MWA or EWTA, lessees will be required to contact and coordinate activities with the appropriate base commander(s). Proposed structure removals within an explosive dumping area may require special mitigation. The SEA will assess this need and suggest mitigative measures.

The alternative of leaving a structure in-place will mitigate some environmental and resource concerns. However, the retention of obsolete structures on the OCS may be an additional concern of the DOD. Obsolete structures may hamper military operations within a MWA or EWTA. Leaving a structure in-place may also be a strategic defensive concern to the DOD.

Existing military use/warning area stipulations, shallow hazard survey data, and SEA mitigation measures, if necessary, are expected to reduce the anticipated level of structure-removal impacts to a very low level for explosive methodologies. Nonexplosive structure removals are expected to have no effect on military use/warning areas or explosive dumping areas. The alternative of leaving obsolete structures in-place is expected to have a low level of impact to these areas.

4. Navigation and Shipping

Waterborne commerce existed in the GOM long before the first oil and gas structure was emplaced. Over the years, an extensive shipping pattern developed in relation to the locations of the major GOM ports and the Straits of Florida and Yucatan. As oil and gas development began to move offshore and the density of structures increased, the potential for collisions between vessels and fixed structures became a significant problem. Since 1960, MMS has recorded at least 60 such accidents involving vessels and structures that resulted in a variety of damage to both entities (USDI, MMS, 1986).

The key mitigation factor for resolving this problem was the establishment of a series of vessel safety fairways and anchorages that provide unobstructed approaches to GOM major ports. A safety fairway is a lane or corridor 2 nmi (3.7 km) in width for vessel trafficking in which fixed structures, whether temporary or permanent, will not be permitted to be emplaced. An anchorage is an area contiguous to and associated with a safety fairway, in which vessels may anchor while awaiting port access. Fixed structures may be permitted in an anchorage but certain spacing limitations are required (33 CFR 166).

Fairways play an important role in the avoidance of collisions between vessels and fixed structures on the OCS, particularly in the case of the less maneuverable, larger oceangoing vessels. However, not all vessels (large or small) stay within the safety fairways. Many, such as fishing boats and vessels supporting offshore oil and gas operations, travel through areas with high concentrations of fixed structures. In such cases, the most important mitigation factor for avoiding collisions is the requirement for adequate marking and lighting of structures. It is interesting to note that after a structure has been in-place for a while, it often becomes a "landmark" and an aid to navigation for vessels that operate in the area on a regular basis.

In addition to the safety fairways, substantial marine traffic utilizes the Gulf Intracoastal Waterways. Vessels with adequate clearance that operate along the coast may use these waterways, bays, and estuaries for protected transit across the PEA area.

Impacts to navigation and shipping resulting from the removal of fixed structures on the OCS are expected to be both positive and negative. The positive impacts of structure removals will be most noticeable when the activities take place in areas of high structure density or where these activities are near safety fairways, anchorages, or ports. Removals are expected to improve the operational aspects of most marine navigation and reduce the probability of structure-vessel collisions. Recreational boats and helicopters that depend on well-known structures as navigational aids are expected to experience a low level of adverse impacts resulting from structure removals. The overall impacts of structure removals on navigation and shipping are expected to be very low. Assuming that the proper navigation aids would be maintained and that integrity of the structure would be maintained, the alternative of leaving structures in-place is expected to have a low impact on navigation and shipping.

5. Pipelines and Cables

Operations during the removal of a structure are not expected to have inpacts on pipelines in the work area. Before the removal of a structure, all pipelines are purged, severed, and capped (sealed) and services such as electric, telephone, and water are disconnected. The pipelines are either abandoned *in situ* according to Title 30 CFR, Part 250, Section 250.18(d) and Part 256, Subpart N, Section 256.89(a)(6) or they are realigned for connection to another structure or pipeline. The components of the disconnected services are handled according to the lessee's/operator's deactivation plan for the dismantling of the structure.

Regardless of operational status, existing pipelines and other potential hazards within 492 ft (150 m) of the structure-removal operations (including accompanying anchoring patterns for the support vessels) shall be buoyed in accordance with Notice to Lessees and Operators 83-3. Compliance with these procedures mitigates the potential impacts to the pipelines or other potential hazards during the removal of a structure.

Pipelines installed on the seafloor of the GOM OCS to a water depth of 200 ft (61 m) are required to have a soil cover as specified by the Department of Transportation and USDI regulations under which the permit for installation of the pipelines was issued, unless the physical environment along the route prevents covering of the pipelines. Additionally, some pipelines are covered externally with a coating that affords not only protection from sources of extraneous impacts but also provides greater stability in the soils in which they are installed.

Generally, the soils in the PEA area in which pipelines are emplaced consist of unconsolidated material that is loosely compacted with intervening spaces between the particles. These unconsolidated soils are expected to provide poor transmission of energy to a buried pipeline or cable from a nearby explosive charge utilized to remove a structure.

In consideration of the above factors, the blast energy from a detonated charge placed at least 16 ft (5 m) below the mud line in the leg, piling, or caisson of a structure is not expected to harm a nearby pipeline or cable. Nonexplosive means of structure removal and the nonremoval alternative are also not expected impact pipelines or cables.

6. Other Mineral Resources

A sulphur and salt lease sale is scheduled for the CGOM Planning Area in December 1987. Prior experience in the GOM with exploring, developing, and producing these resources should provide a background to anticipate and resolve impacts from these operations. Modification and/or movement of the sulphur-producing structures are designed into a company's development and production scenarios.

The State of Louisiana has expressed interest in mining sand in offshore waters for dune and beach replenishment. The State's latest proposals involved areas within its own territorial waters. Potential mining operations on the Federal OCS may be significantly hampered by economic consideration. Therefore, no conflicts are projected between potential sand mining operations and structure-removal activities.

There are no known manganese or other hard mineral nodule deposits in the PEA area which might be exploited by offshore mining. At present, there are no other plans or proposals for mining of other minerals from the PEA's OCS seafloor.

Structure-removal activities are not expected to impact any other mineral resources on the OCS within the PEA area. The alternative of leaving a structure in-place is not expected to impact other mineral resources but may hamper operations to recover those resources. A very low level of impact is therefore estimated for this alternative.

7. Human Health and Safety

Structure-removal operations, as well as any other offshore oil field work, may be hazardous to its workers. Lifting and towing operations are an integral part of all current structure-removal activities. The weight of the massive structures and equipment of a structure-removal operation place enormous stresses on mechanical lifting and towing components. Breakage of a line under load or failure of a derrick boom could seriously injure or kill nearby personnel. Even under normal operating conditions, workers must be cognizant of the potential for crushing or shearing injuries when structures are lifted, swung, and loaded onto material barges for transportation to their destinations.

Minor injuries may occur through thoughtless or careless actions by personnel. Structure-removal operations utilizing explosives may leave jagged edges on the legs or pilings. The biofouling community that adheres to the structure may pose a handling hazard to personnel. Cutting and welding operations have special safety precautions to minimize potential injuries to workers.

In addition to these general, potentially hazardous conditions for workers in structure-removal activities, both explosive and nonexplosive removal methodologies have their own inherent hazards. Handling and transporting explosives have special precautions to avoid unacceptable risks. Handling of Class A explosives should be done by or under the direction and supervision of appropriately trained and experienced personnel. Likewise, transportation of Class A explosives should be conducted in accordance with requirements prescribed by the Department of Transportation and the U.S. Coast Guard.

Explosives of some type may be used on all structure removals. At present, bulk explosives are routinely used to sever the multiple-string, cemented conductors and casing of permanently abandoned wells. Alternative methods for this particular application are not as successful or preferred by salvage companies over bulk explosive means. Preparing, priming, placing, and detonating explosives should be done by technicians properly trained to conduct these operations.

Divers face potential dangers from both explosive and nonexplosive structure-removal activities. After a crew jets soil out of the structure's leg or piling 16 ft (5 m) below the seafloor, divers descend inside the legs to place explosive charges or to conduct underwater arc cutting operations. Conditions are confining with no ambient light and with poor visibility due to turbid waters. Underwater arc cutting operations also have the possibility of encountering pockets of gas adjacent to the legs or pilings. Ignition of these could result in an explosion that may seriously harm a diver. Divers also face the risk of a piling or leg shifting when stress is relieved as they sever a member of the structure.

There are numerous ways to mitigate potential hazards to human health and safety. Effective safety and maintenance programs will reduce risks to structure-removal personnel. Provisions in 30 CFR 250.46 mandate safe and workmanlike operations on the OCS. Additionally, OCS Order No. 5 incorporates by reference "API Recommended Practices for Operation and Maintenance of Offshore Cranes." OCS Order No. 5 also mandates "Employee Orientation and Motivation Programs for Personnel Working Offshore." Here MMS also incorporates by reference "API Recommended Practice Orientation Program for Personnel Going Offshore for the First Time" and "API Employee Motivation Programs for Safety and Prevention of Pollution in Offshore Operations." Shallow hazard surveys, as required by OCS Order No. 2, NTL 83-3, and "as-built" pipeline data, may provide valuable data to the lessees or operators in structure-removal operations.

The alternative of leaving a structure in-place also carries some potential hazards to human health and safety. Failure of a structure's aids to navigation or failure to maintain structural integrity may endanger maritime personnel.

Sufficient legal and regulatory guidance exists to lessen the hazards faced during structure-removal operations. Effective implementation and adherence to safety and maintenance programs are the keys to mitigating potential hazards. Very low impacts to human health and safety are estimated during structure-removal activities if appropriate precautions are taken by lessees, operators, and their contractors.

E. UNAVOIDABLE ADVERSE IMPACTS

The primary concern of structure removals is the potential impact to protected, threatened, and/or endangered species as a result of utilizing explosives to sever a structure's legs, pilings, or caissons. Should these animals or other biota be in proximity to a structure during detonation of the main charges, they could be injured or killed. Individual SEAs will address specific mitigative measures to be taken by the lessee/operator for the protection of protected, threatened, and/or endangered species.

Secondly, the potential loss of habitat to the marine environment as a result of the actual structure removals is an identifiable impact. Economic conditions play a major role in the decisions of petroleum companies to continue production and to maintain their offshore structures. Inevitably, the structure will be removed and its marine habitat will be lost from the immediate area. Exploration departments within these same companies must judiciously evaluate prospects to determine if construction and emplacement of new structures are warranted. Under the currently, depressed economic conditions in the oil and gas industry, fewer structure installations are anticipated and more structure removals are projected, causing a net loss of habitat. Conversion of obsolete structures to reef habitat could do much to mitigate the loss of habitat to the marine environment. Other unavoidable adverse impacts are minor and are addressed in Table III-1 of this PEA.

IV. PUBLIC OPINION

Several environmental groups have written to petroleum companies expressing their concern over explosive structure removals and potential impacts to protected, threatened, and/or endangered species. Both Greenpeace and the Center for Environmental Education have expressed their concern on these matters. The NMFS has also expressed its concern regarding coincidental strandings of dead sea turtles and preborn porpoises with some structure removals in State waters. Endangered Species Act, Section 7 consultations between NMFS and MMS are being conducted on proposed structure removals to evaluate the potential impacts on endangered or threatened species.

Since the Regional Director's (MMS, Gulf of Mexico OCS Region) letters of August 19, 1986, and December 9, 1986, (Appendix A) to lessees and operators regarding structure removal notifications, proposals for structure removal operations have dramatically decreased. The structure removals allowed under these new requirements have been under controlled conditions with mitigation measures developed by MMS and NMFS and implemented by the lessees/operators to minimize potential impacts to protected, threatened, and/or endangered species (USDI, MMS, 1986).

It appears that explosive structure removals will continue to be of concern to environmental groups and resource protection agencies because of the potential impacts to protected, threatened, and/or endangered species. Implementation of proper mitigation during explosive structure removals and compliance with the Endangered Species Act and the Marine Mammal Protection Act are expected to help minimize these concerns.

A total industry shift to nonexplosive structure removals would eliminate environmental concerns, but would probably not be satisfactory to the oil and gas industry. Such a shift would increase structure-removal costs and would force the use of methods which may not be well suited to individual structure removal operations.

The alternative of leaving structures in-place would be satisfactory to environmental concerns and recreational fishing groups, but would be of concern to military interests, maritime industries, and commercial net fishermen. The oil and gas industry would also be concerned if they were responsible for retaining liabilities and maintenance costs for abandoned-in-place structures.

V. CONSULTATION AND COORDINATION

MMS is aware that the use of explosives to remove platforms, caissons, or other petroleum-related structures could harm protected marine mammals and threatened and/or endangered sea turtles. As a result, several consultations and meetings pertaining to this potential problem were held with representatives of NMFS and offshore oil and gas lessees/operators.

On November 17, 1986, MMS and NMFS developed a final action plan to implement Endangered Species Act, Section 7 consultations on structure removals in the GOM. The plan was designed to expedite the formal consultations. Appendix C provides a copy of this document.

On November 25, 1986, the NMFS rendered a biological opinion on a specific structure removal in the Galveston Lease Area. It was recommended that oil and gas structures targeted for "expedited, near-term" removals should incorporate systematic tests that will help determine the factors that adversely affect protected, threatened, and/or endangered species and other marine life. In addition, the following recommendations were given for obtaining additional information to assist MMS and NMFS in evaluating the impacts of structure removals during future consultations:

1. An extensive review of the existing literature on the effects of explosives on marine life should be conducted. This information should then be analyzed and applied to the marine mammal-sea turtle-oil and gas structure-removal issue to determine such things as: (a) impact zones; (b) safe peak pressure and impulse criteria; (c) vulnerability to underwater shock waves and sound; and (d) lethal range predictions.

2. Measurements of peak pressure and impulse should be obtained at various depths and locations around the structure using a variety of test explosives currently in use and/or available to the salvage industry. An evaluation of the least damaging explosive method for rig removals is needed.

3. An issue paper discussing alternative methods for structure removals and the applicabilities of these methods should be prepared by MMS.

4. Research should continue with a systematic approach to determine the effectiveness of various "turtle scare" methods (i.e., scare charges, sonic guns, divers, etc.).

5. Surface and seabed drifters should be released at the structure-removal sites to determine the correlation (if any) between fish and sea turtle strandings and the use of explosives.

6. Structure removals should occur during daylight hours, if possible, so that pre- and post-detonation surveys and observations can be efficiently made. Consultation and coordination for individual structure removals will be discussed in each SEA.

On January 13, 1987, a formal Endangered Species Act, Section 7 consultation with NMFS was initiated to discuss structure removals. (This discussion was held in conjunction with the consultation for proposed Oil and Gas Lease Sales 113, 115, and 116.) Until NMFS renders a biological opinion on the removal of all offshore structures with explosives, MMS is conducting Endangered Species Act, Section 7 consultations for structure removals or groupings of structure removals which utilize explosives. .

The Regional Director has established a working group composed of MMS, NMFS, U.S. Fish and Wildlife Service, and Offshore Operators Committee representatives to advise him on matters related to sea turtles, marine mammals, and structure-removal activities. This working group discusses and reviews new environmental, economic, and engineering information for the Regional Director. In addition, the working group nominates studies that will increase the level of knowledge regarding structure removals and potential effects on marine biota from removal operations. The working group also serves to coordinate the dissemination of information from MMS to other Federal agencies and to industry.

The MMS requires lessees/operators to notify the Regional Director at least 30 days prior to a proposed structure removal. This notification should include all the necessary information to evaluate a proposed structure removal and to conduct the required NEPA review and, if appropriate, Endangered Species

Act, Section 7 consultation. (See Appendix A for the Regional Director's letters regarding the notifications and the structure-removal data form.)

Coordination activities continue between the lesses/operators and the Federal government. Frequently, MMS personnel contact lessee/operators to gather additional data or to clarify data submitted with a structure-removal notification. This coordination facilitates the review and evaluation of the proposed activities by the resource scientists who prepare the MMS requests for Section 7 consultations that are transmitted to the NMFS, who in turn, uses these data and additional information to prepare their biological opinion regarding threatened and endangered species. Ultimately, the MMS incorporates the mitigation measures and the incidental take statement from the NMFS biological opinion into a letter to the lessees/operators so that their proposed structure-removal activities will minimize the potential impact to threatened and endangered species.

Representatives from the MMS and NMFS serve as observers to monitor structure-removal activities. The observers insure that conditions and mitigation measures detailed in the approval letter to lessees/operators are implemented during removal operations.

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APPENDIX A

REGIONAL DIRECTOR'S LETTERS TO LESSEES AND OPERATORS DATED AUGUST 19, 1986 AND DECEMBER 9, 1986

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
GULF OF MEXICO OCS REGION
1420 SOUTH CLEARVIEW PARKWAY
NEW ORLEANS, LOUISIANA 70123-2394

In Reply Refer To: ORD

August 19, 1986

Gentlemen:

This office has recently received a number of inquiries concerning the removal of offshore platforms, the technique used, and the resulting effect on marine life. The National Marine Fisheries Service (NMFS) reports that some 138 dead stranded sea turtles have washed ashore on the upper Texas and Louisiana coasts since March 1986. Most of the strandings were of the endangered Kemp's ridley species. Wash-ups of dead fish and preborn porpoises were found along with the stranded turtles. Since a number of platforms in State waters offshore Texas were removed during this time, it has been suggested a correlation exists between platform removals through the use of explosives and the turtle strandings.

The Minerals Management Service (MMS) has very limited information concerning a relationship between turtle kills and platform removals. We are, however, working closely with the Offshore Operators Committee and NMFS to learn more about the problem. Moreover, we are looking toward identifying alternate techniques to be used in the removal process as well as modifying current procedures which would greatly lessen the danger to surrounding marine life. To that end, we request that commencing immediately, you notify this office 30 days in advance of any platforms your company plans to remove. The notification should include:

- Complete identification of platform(s)
- Size of platform (number and size of legs and pilings)
- Removal technique to be employed (bulk charge or shape charge; multi- or single-shot)
- Amount and type of explosive per charge
- Number and size of well conductors to be removed and removal technique

Such notification and information will enable the MMS in cooperation with NMFS to plan and implement a structured monitoring program. With your full cooperation, we are confident techniques and processes can be found which will allow the orderly removal of abandoned structures without imposing any threat to surrounding marine life.

Sincerely yours,

J. Rogers Pearcy

J. Rogers Pearcy
Regional Director

In Reply Refer To: ORD

DEC 9 1986

Mailed to all Lessees and Operators

Gentlemen:

This office issued a letter to Lessees and Operators on August 19, 1986, identifying the possibility of an impact on certain endangered marine species, specifically the Kemp's ridley turtle, resulting from the use of explosives to remove Gulf of Mexico platforms. Although present information only suggests a correlation between explosive use during platform removals and turtle strandings, the Director of the Minerals Management Service (MMS) has informed the National Marine Fisheries Service (NMFS) that platform removals involving explosives "may affect" endangered species. Thus it is necessary, in accordance with the Endangered Species Act (ESA), that such OCS operations be considered on an individual basis.

The MMS in coordination with NMFS has established procedures to effect an interagency ESA Section 7 consultation on all proposed platform (jacket and caisson) removals and associated well conductor removals. The information requested by the enclosed form will be utilized to initiate these Section 7 consultations. In order to expedite these consultations, operators are requested to provide this information with the notification of a proposed OCS platform/structure removal.

This information is required for all platform removal notifications. Proposed removals utilizing methods other than explosives can be allowed by this office without initiating an ESA Section 7 consultation. When explosives are proposed for use in the removal, consultation is necessary. In either case, approval by this office must be obtained prior to proceeding with the removal operations.

Your cooperation in supplying the information required by the enclosed form will expedite the process necessary for each structure removal.

The NMFS and MMS are presently discussing certain data gathering projects which are proposed to be carried out in conjunction with some near term platform removal operations using explosives. These data gathering projects will provide information which will be used to effect a resolution of the apparent conflict between endangered species and platform removal.

As part of individual platform removal applications, a lessee may be requested to provide for measures to assist in this data gathering effort. With your continued cooperation, we are confident that a resolution will be obtained in a timely manner.

Sincerely yours,

(Orig. Sgd.) J. Rogers Pearcy

J. Rogers Pearcy
Regional Director

Enclosure

cc: Mr. W. A. Baute, Chairman
Offshore Operators Committee
Post Office Box 60149
New Orleans, Louisiana 70160

BEST COPY AVAILABLE

PROPOSED OCS PLATFORM/STRUCTURE REMOVAL

I. Responsible Party

A. Lease Operator Name ____________________

B. Address ____________________

____

C. Contact Person and Telephone Number ____________________

____

II. Identification of Structure to be Removed

A. Platform Name ____________________

B. Location (Lease, Area, Block, and Block Coordinates) ____________________

____

C. Date Installed (Year) ____________________

D. Proposed Date of Removal (Month/Year) ____________________

E. Water Depth ____________________

III. Description of Structure to be Removed

A. Configuration (Attach a Photograph or a Diagram)

B. Size ____________________

C. Number of Legs/Casings/Pilings ____________________

____

D. Diameter and Wall Thickness of Legs/Casings/Pilings ____________________

____

E. Are Piles Grouted? ____________ Inside or Outside? ____________

F. Brief description of soil composition and condition ____________________

____

____

IV. Purpose

Brief discussion of the reason for removing the structure ____________________

____

____

V. Removal Method

A. Brief description of the method to be used ____________________

____

____

B. If explosives are to be used, provide the following:

1. Kind of Explosives ____________________

2. Number and Sizes of Charges ____________________

a. Single Shot or Multiple Shots? ____________________

b. If multiple shots, sequence and timing of detonations ____________

____

3. Bulk or Shaped Charge? ____________________

   a. Depth of Detonation Below Mud Line ____________________

   b. Inside or Outside Piling? ____________________

   ____

C. Pre-Removal Monitoring Techniques

1. Is the use of scare charges or acoustic devices proposed? ________

   If yes, provide the following:

   a. Number and Kind ____________________

   b. Size of Charges ____________________

   c. Brief description of how, where, and when scare charges or acoustic devices will be used ____________________

   ____

   ____

2. Will divers or acoustic devices be used to conduct a pre-removal survey to detect presence of turtles and marine mammals? ________

   If yes, briefly describe the proposed detection method ________

   ____

   ____

D. Post-Removal Monitoring Techniques

1. Will transducers be used to measure the pressure and impulse of the detonations? ____________________

2. Will divers be used to survey the area after removal to determine any effects on marine life? ________________________________

VI. Biological Information

If available, provide the results of any recent biological surveys conducted in the vicinity of the structure. If available, describe any recent observations of turtles or marine mammals at the structure site.

APPENDIX B

PLATFORM REMOVAL TECHNIQUES

PLATFORM REMOVAL
TECHNIQUES

by

Lars Herbst

Technical Assessment and Operations Support Section

Field Operations

December 1986

U.S. Department of the Interior/Minerals Management Service

PLATFORM REMOVAL TECHNIQUES

OVERVIEW

The Technical Assessment and Operations Support Section of Field Operations has recently been involved with identifying alternate means to explosives for platform removal. This involvement arose since it has been suggested a correlation may exist between platform removals through the use of explosives and the stranding of some 138 dead sea turtles. These strandings, which included many of the endangered Kemp's ridley turtles, occurred along the Texas and Louisiana coasts between March and August 1986.

MINERALS MANAGEMENT SERVICE REQUIREMENTS

According to a stipulation in the lease agreement, MMS requires that lessees must clear the lease within one year after expiration of the lease. OCS Order No. 3, subsection 2.9, requires that in clearing the location, "All casing, wellhead equipment, and piling shall be removed to a depth of at least 16 feet below the ocean floor, or to a depth approved by the district supervisor after a review of data on the ocean bottom conditions." In addition to these requirements, MMS requested in August that all lessees planning to remove any platform shall notify MMS 30 days in advance. The notification should include:

1. Complete identification of platform(s)

2. Size of platform (number and size of legs and pilings)

3. Removal technique to be employed (bulk charge or shape charge, multi- or single-shot)

4. Amount and type of explosive per charge

5. Number and size of well conductors to be removed and removal technique

In December all lessees/operators were sent a copy of a form which must be completed to initiate the platform removal process (see Attachment 1). After review for completeness, MMS Regional Office will prepare a summary evaluation. This summary is normally completed and forwarded to the MMS Headquarters coordinator within 10 working days. A copy is also sent to the National Marine Fisheries Service (NMFS) office in St. Petersburg, Florida. The NMFS will provide a biological opinion within 30 days, but has agreed to provide a prompt turn around on the opinion. The opinion will be either a "jeopardy" or "no jeopardy" decision. A "no jeopardy" opinion contains an incidental take statement and any appropriate "reasonable and prudent measures" to minimize impacts of any projected incidental take. The MMS Gulf of Mexico (GOM) Regional Office then notifies the lessee/operator to proceed with the removal taking whatever conditions it considers necessary or appropriate. To date, there has been one application received and processed, and several other applications have been received and are being processed.

CURRENT TECHNOLOGY

In the past, most platform/caisson removals were routinely accomplished by using bulk explosive charges to sever the platform support legs, pilings, and caissons. Concurrent with production platform removals, many conductor/casing strings are also removed by bulk explosive charges. Due to a need perceived by MMS for improvements in past procedures, current and emergent technology were examined.

Current technology available for platform removal includes: bulk explosives, shaped explosive charges, mechanical cutter, and an underwater arc cutter. The use of bulk explosives for platform removal has been the most common procedure, accounting for approximately 90 percent of platform removals. Mechanical cutting and underwater cutting account for nearly 7 percent, with the remainder removed by shaped explosive charges.

BULK EXPLOSIVES

The basic explosives used in bulk form for platform removal include RDX, C-4, compound B, and nitromethane. The first three are considered Class A explosives, and must be transported in accordance with Department of Transportation (DOT) and the U.S. Coast Guard (USCG) Regulations. Nitromethane is classified as a flammable liquid and does not become an explosive until it is sensitized by adding ethylenediamine (generally 95 percent nitromethane and 5 percent amine). Because nitromethane is easily transported and stored it has become the most widely used explosive for platform removal.

It has been suggested that one of the most important properties of explosives is the detonating velocity. With low velocity explosives, primary pulse pressure is longer, but the amplitude is lower. With a high velocity explosive, primary pulse rate is short and the amplitude greater. Although not experimentally proven, it is believed that the impulse (area under the pressure-time curve), lb-sec/in^2, is what is most likely to injure or kill marine life (i.e., sea turtles and fish with swim bladder).

The following is a comparison of different explosives:

Explosive	Detonating Velocity	Brisance*
RDX	approx 26,900 ft/sec	1.35
C-4	approx 26,250 ft/sec	1.15
Comp.-B	approx 25,600 ft/sec	1.32
Nitromethane	approx 20,370 ft/sec	.90

*Brisance is the measure of shattering power as compared to TNT which has a brisance of 1.00.

The major advantages of bulk explosives are the relatively low cost and the short amount of time needed to accomplish the platform removal. This method can be easily adapted to most caisson/leg/piling configurations of a platform. If the inside of the leg/piling can be jetted out to 15 feet below the seafloor, the explosive can be placed inside of the leg/piling, and thereby decrease the resulting pressure impulse.

Recent developments have led to an effort to focus the explosive energy of the bulk charge to the target. An example of this technique would be the use of a ring charge which concentrates the explosive near the inner wall of the leg/piling/caisson to be cut. (See Figure 1.)

Calculations for weight of bulk explosives required to sever piles/conductors are rarely used by the explosive industry. Instead, the industry relies on past experience to determine explosive weight. Experience factors of several contractors are listed in Attachment 2.

SHAPED CHARGES

Another method for platform removal is the use of high velocity (HV) shaped explosive charges. This method is reported to have some advantages over bulk explosives and has been used in combination with smaller bulk charges. The cutting action obtained by a shaped charge is accomplished by focusing the explosive energy with a conical metallic liner. (See Figure 2)

The major advantage of HV shaped charges is that the total amount of explosive required is considerably less and it has been reported that the pressure in the water column can be reduced by as much as 75 percent. (See Attachment 3) There are several disadvantages of shaped charges: they must be placed with an exact standoff in relation to the leg/piling and it is often difficult to place shaped charges inside a leg/piling because of obstructions or the batter of the platform; the standoff must be air, not water; the explosive power of shaped high velocity charges are quickly dissipated after detonation because of the lower explosive weight and the focusing effect; and it is difficult to use shaped charges to cut multistring casing/conductors which have been cemented. Calculations for the explosive weight of a shaped charge necessary to sever piles are more exact than those for bulk explosive weight. Equations for explosive weight of pressed RDX are included in Attachment 4.

MECHANICAL CUTTERS

The use of mechanical cutters, often used in conductor removal, has recently been expanded to platform removals. The mechanical cutter tool is currently capable of removing cemented multi-string casing/conductors up to 72 inches in diameter. The tool is usually a three-armed model with tungsten carbide tipped blades/arms. (See Figure 3) To cut the leg/pile the mud plug inside (if present) must be jetted out to allow the cutter assembly to reach the appropriate depth. A new design of the tool assembly has been developed which allows the jetting and cutting to be performed with one trip per leg/pile. The cut is initiated by rotating the assembly and supplying pump pressure to force the blades out into the inner wall of the leg/pile. The rotation can be accomplished by the use of a power swivel at the surface. A stabilizer is run just above the tool to keep it centered in the leg/pile. (See Figure 4) The pump uses seawater to supply pressure and lubrication to the blades. The tungsten carbide tipped blades are normally changed out after each cut is completed. Because the supporting crane cannot take the torque of the cutting action, some system of support on the jacket leg must be provided to handle the torque. Some of the advantages of this technique include a relatively clean cut and the damage to marine life is minimal or nonexistent. The rotating time to complete the cut varies from 45 minutes for 30-inch O.D. by 3/4-inch wall thickness to 5 hours for 60-inch O.D. by 2-inch wall thickness. The cutting time is an important economic factor if a derrick barge is being used. However, it has been mentioned that this method, as a result of the increased derrick barge time, can end up costing nearly twice as much as a removal by explosives. A new development under consideration would not involve the use of a derrick barge until the jacket is ready for hoisting. The scenario would involve cutting up the deck section and removing it piece-by-piece using a jack-up barge with a crane and a barge to receive the scrap. Also, at this point several legs/piles can be mechanically cut simultaneously to save time. It is believed that the economics of this removal technique are still unsettled at this point. Besides the economic disadvantages of mechanical cutters, removal by mechanical means can be very difficult if there is a batter or obstruction in the platform/leg.

UNDERWATER ARC CUTTING

The only other technique successfully used for platform removal is underwater arc cutting by diver. To use this method, the mud plug inside the pilings must be jetted out to allow the diver and equipment to be lowered 16 feet below the mud line. (See Figure 5) The divers first cut is usually a 6 to 8-inch vertical cut which acts as a vent and a reference line. The circumferential cut is then made with the diver changing electrode rods in the torch when necessary. The total time needed to make the cut is directly related to water depth, leg/pile diameter, and wall thickness of the leg/pile. The following demonstrates the type of diving related to water depth:

Water Depth	Type of Diving
0-Approx 170'	Diver breathes air, bottom time reduces with depth
Approx 170' - 300'	Diver is on mixed gases, and decompression time to surface increases
300' and greater	*Diving bell assisted using two divers

*Diving bell will not enter 60-inch diameter or less piling

An example of the average amount of time to actually cut a piling is 20-25 minutes for a 30-inch O.D. by 1-inch wall thickness. One advantage of using a diver and arc cutter is the legs/pilings/caissons are cut evenly and therefore makes the hoisting to the barge easier. Another advantage is that the damage to surrounding marine life is minimal or nonexistent. Some of the disadvantages include the cost in removing platforms in water depths greater than 170 feet; the danger a diver is exposed to including explosion or "blow back" and the possibility of piling/leg shift when stress is relieved.

The recent removal of a platform with four 60-inch diameter x 1 5/8-inch wall thickness piles in 130 feet of water has demonstrated this technique to be a proven method. However, the offshore operator was quick to point out this process exceeded what the job would have cost if explosives were used by $70,000.

OTHER TECHNOLOGY

Possible emerging technology for platform removal includes an abrasive sand-type cutter, chemical-type cutter, radial cutting torch, hydraulic ram-type cutter, and cryogenic fragmentation. These techniques are not currently being used for platform removal but are being examined by the industry to determine the feasibility of their use.

Abrasive sand-type cutters have been used successfully for conductor and multiple string casing removal, and their effectiveness in cutting legs/piling are presently being investigated. The cutter-head of the sand-type cutter must be lowered inside the leg/piling and must be rotated while the sand is pumped down to the cutting head. (See Figure 6) Rotation may be accomplished by the use of a power swivel at the surface or possibly a downhole motor. The cutter-head must also have a centralizer to provide a standoff of about 1 to 1 1/2 inches between the cutter-head and the surface to be cut. This assembly must be supported at the surface or hung from a crane over the leg/piling to be cut. The operation, and problems associated with it, would be very similar to mechanical cutter operation previously discussed. The technology of cutting steel/concrete with sand is proven, but operational logistics of platform removal using an abrasive sand-cutter are complex and largely unproven.

At the present, the chemical-type cutter has only been used to cut tubing and drill pipe. (See Figure 7) However, some industry personnel believe this technology could be expanded upon and used to cut platform legs/pilings. The proposed tool would be run on electric wire line and uses a rocket-type propellant to jet bromine triflouride into the inner wall of the leg/pile. The bromine triflouride, which cuts by an oxidizing process, is quickly spent and turns into a salt compound as the end product. The development cost of this tool is considered to be high because a whole suite of tools would have to be developed for the various diameters of legs/piles.

The radial cutting-type torch, which utilizes powdered metals as the cutting agent, is currently only used to sever drillpipe, tubing, and small casing (5-inch maximum). The cutting agent is neither an explosive nor a chemical, but is classified as a flammable solid. The electrically ignited torch has an output temperature of nearly 6,000°F, which far exceeds the melting point of steel. The torch assembly is run on wireline and requires no rotation. Conceptually, several jacket piles could be cut simultaneously provided there are sufficient number of wireline winches. The cutting time of the piles is expected to be nearly instantaneous. If the technology can be expanded to cut piles and multistring casing/conductors the process could possibly be economically competitive with explosives.

One other method that has received some attention lately is the use of a hydraulic ram-type cutter. A European group, Rauma-Repola/Diaber, has developed this method which they claim is capable of cutting piles up to 27 inches in diameter, with a cutting time of 8 to 10-minutes. Details on the tool are scarce because the tool has not been introduced to the U.S. market.

The cryogenic fragmentation procedure was recently developed and has been proposed to be tested during an upcoming removal. The technique involves the use of liquid nitrogen to cool steel to the cryogenic temperature at which time the steel can be fractured by a fragmentation method. The fragmentation methods that have been suggested include small amounts of explosives or a mechanical impact tool. The cryogenic procedure was successfully land tested using 200 gallons of liquid nitrogen to cryogenically cool a 48" O.D. x 1 1/2" W.T. caisson. The cooling process during this test took approximately 45 minutes. It is believed this technique, if proven by testing, could be economically competitive with explosives.

Several companies have designs "on the board" for various platform techniques. A local company has discussed with MMS its desire to build a hydraulic ram-type cutter which would conceptually have cutting times similar to the tool developed by Rauma-Repola/Diaber. However, this tool would be run inside the leg/pile on a wireline with a hydraulic line attached to activate the cutter. It has been suggested this tool could be economically competitive with explosives if testing proves the tool and development costs can be kept low.

Other companies are currently looking into an electrical-type cutter and laser technology. These technologies are only in the conceptual or design phase, and little is known about operational procedures or costs.

PROPOSED OCS PLATFORM/STRUCTURE REMOVAL

I. Responsible Party

A. Lease Operator Name ______________________________

B. Address ______________________________

____

C. Contact Person and Telephone Number ______________________________

____

II. Identification of Structure to be Removed

A. Platform Name ______________________________

B. Location (Lease, Area, Block, and Block Coordinates) ______________________________

____

C. Date Installed (Year) ______________________________

D. Proposed Date of Removal (Month/Year) ______________________________

E. Water Depth ______________________________

III. Description of Structure to be Removed

A. Configuration (Attach a Photograph or a Diagram)

B. Size ______________________________

C. Number of Legs/Casings/Pilings ______________________________

____

D. Diameter and Wall Thickness of Legs/Casings/Pilings ______________

____

E. Are Piles Grouted? __________ Inside or Outside? __________

F. Brief description of soil composition and condition ______________

____

____

IV. Purpose

Brief discussion of the reason for removing the structure ____________

____

____

V. Removal Method

A. Brief description of the method to be used ______________________

____

____

B. If explosives are to be used, provide the following:

1. Kind of Explosives ______________________________

2. Number and Sizes of Charges ______________________

a. Single Shot or Multiple Shots? __________________

b. If multiple shots, sequence and timing of detonations ______

____

3. Bulk or Shaped Charge? ______

a. Depth of Detonation Below Mud Line ______

b. Inside or Outside Piling? ______

______

C. Pre-Removal Monitoring Techniques

1. Is the use of scare charges or acoustic devices proposed? ______ If yes, provide the following:

a. Number and Kind ______

b. Size of Charges ______

c. Brief description of how, where, and when scare charges or acoustic devides will be used ______

______

______

2. Will divers or acoustic devices be used to conduct a pre-removal survey to detect presence of turtles and marine mammals? ______ If yes, briefly describe the proposed detection method ______

______

______

D. Post-Removal Monitoring Techniques

1. Will transducers be used to measure the pressure and impulse of the detonations? ______

2. Will divers be used to survey the area after removal to determine any effects on marine life? ____________________

VI. Biological Information

If available, provide the results of any recent biological surveys conducted in the vicinity of the structure. If available, describe any recent observations of turtles or marine mammals at the structure site.

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Comparison of Bulk Explosive Weight/Sever - by explosive contractor

Contractor 1 (for Nitromethane)

Pile/Casing Size	Explosive Weight
20" x 1/2" pile	10-15 lbs
20" x 1" pile	20-25 lbs
30" x 1" pile	30-40 lbs
30" x 1 1/2" multistring casing/conductor	45-60 lbs
36" x 1 1/2" multistring casing/conductor	45-60 lbs
48" x 2" multistring casing/ conductor	60-90 lbs

Reduce weights listed by approximately 10 percent if C-4 or Comp-B are used. Also, reduce by 10 percent if ring or "donut" charge is used.

Contractor 2 (for C-4, Comp-B)

For conductor removal,

Explosive weight = 0.75 x largest diameter of multistring casing/conductor.

For example,

Removal of a multi-string casing/conductor of 36" - 20" - 13 3/8" - 9 5/8" would require 27 lbs of C-4, Comp-B.

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FROM: JET RESEARCH CENTER INC.

EXAMPLE: 2000gr I.C.C. VS 40lb BULK CHARGE
TARGET: 20" O.D. x 1/2" wall thickness cut 16' below the mudline

	DISTANCE (ft.)				
	25'	50'	100'	150'	200'
	PRESSURE (psi)				
2000gr ICC (1.3 lbs)	212.0	93.6	41.3	25.6	18.2
40 lb bulk	813.0	359.1	158.5	98.2	69.9

EXAMPLE: 3200gr ICC VS 60lb BULK CHARGE
TARGET: 30" OD x 1" wall thickness cut 16' below the mudline

	DISTANCE				
	25'	50'	100'	150'	200'
	PRESSURE (psi)				
3200gr ICC (3 lbs)	295.7	130.5	57.6	37.5	25.4
60 lb bulk	954.3	421.2	185.9	115.2	82.0

Equations for Calculating Explosive Weight of Pressed RDX Necessary to Sever Piles

For 1/2" wall thickness: use 2,000 grains/foot

Explosive Weight = (Pile I.D. - 2 [standoff] - 2 [length to explosive weight]) x 3.14
= (Pile I.D. - 2 [0.75"] - 2 [1.04]) x 3.14
= (Pile I.D. - 3.58") x 3.14 x 2,000 grain/foot x 1 foot/12 inches
= grains explosive weight
= grains x 1 lb/7,000 grains
= lbs explosive weight

For 1 1/4" wall thickness: use 3,200 grains/foot

Explosive weight = (Pile I.D. - 2 [standoff] - 2 [length to explosive weight]) x 3.14
= (Pile I.D. - 2 [1"] - 2 [1.43"]) x 3.14
= (Pile I.D. - 4.86") x 3.14 x 3,200 grain/foot x 1 foot/12 inches
= grains explosive weight
= grains x 1 lb/7,000 grains
= lbs explosive weight

For 1 1/4" - 2 1/2" wall thickness: use 7,000 grains/foot

Explosive weight = (Pile I.D. - 2 [Standoff] - 2 [length to explosive weight]) x 3.14
= (Pile I.D. - 2 [3"] - 2 [1.93]) x 3.14
= (Pile I.D. - 9.86") x 3.14 x 7,000 grain/foot x 1 foot/12 inches
= grains explosive weight
= grains x lb/7,000 grains
= lbs explosive weight

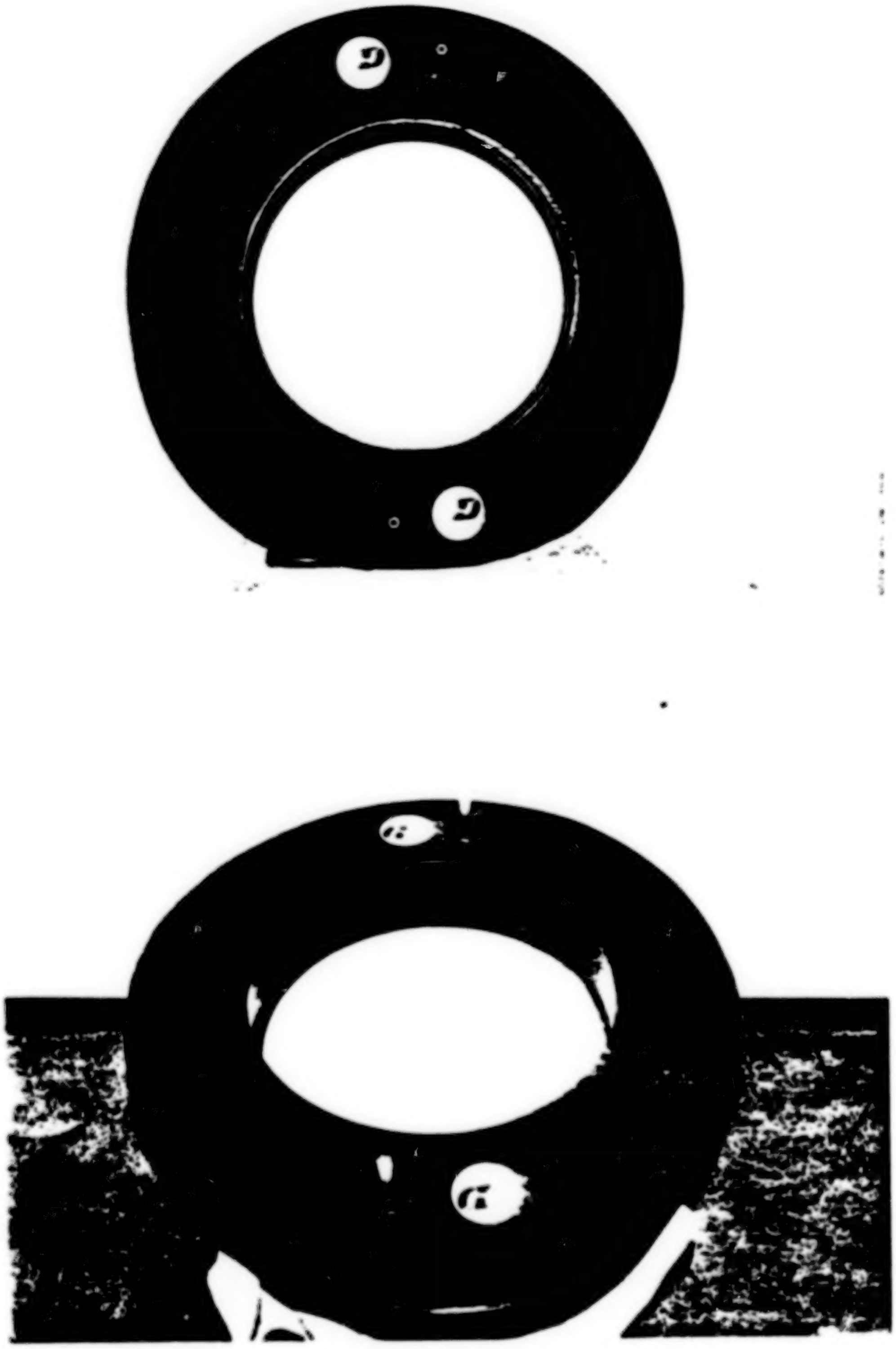

Figure 1. Ring-Shaped Charge

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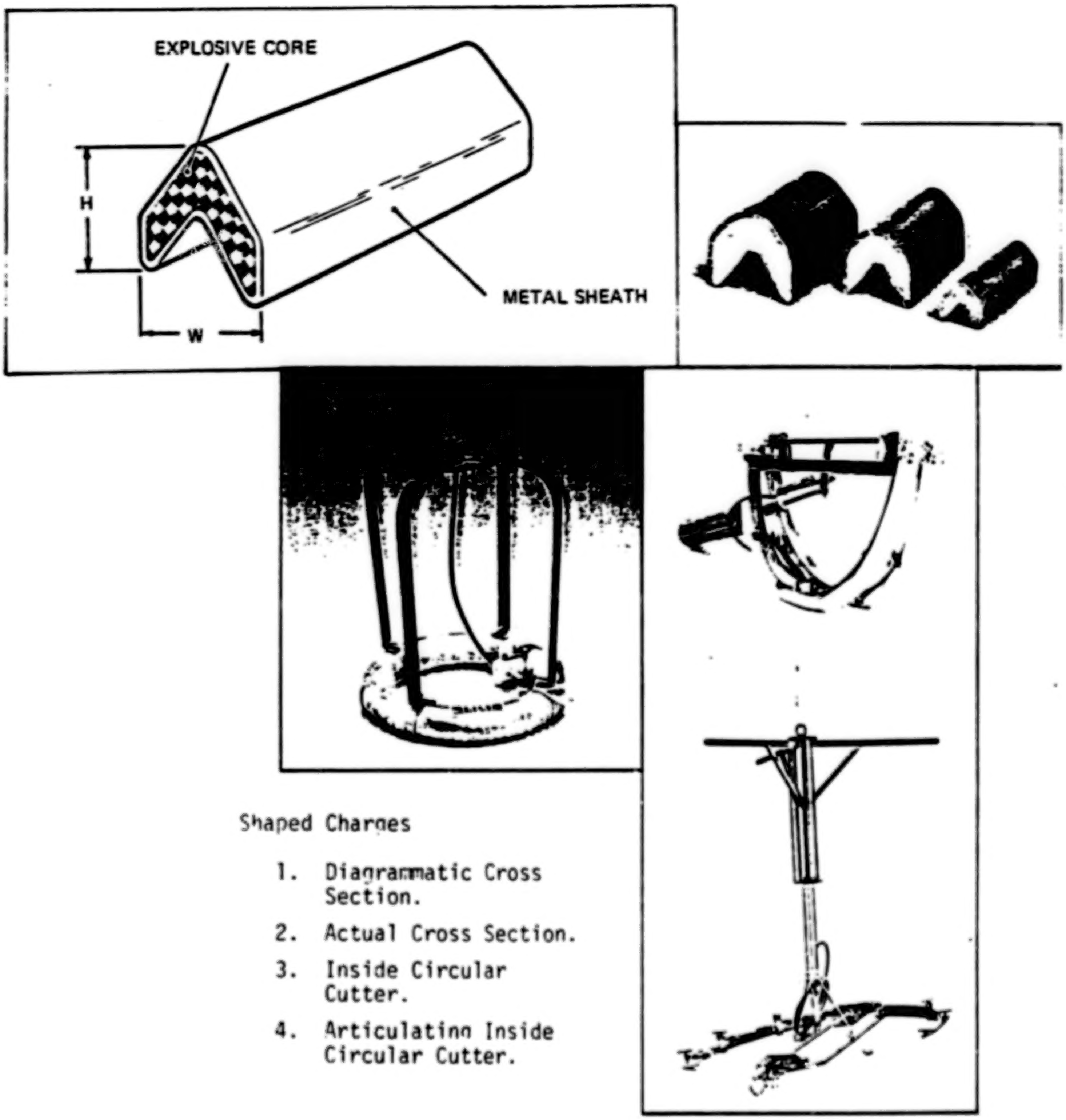

Shaped Charges

1. Diagrammatic Cross Section.
2. Actual Cross Section.
3. Inside Circular Cutter.
4. Articulating Inside Circular Cutter.

Figure 2.

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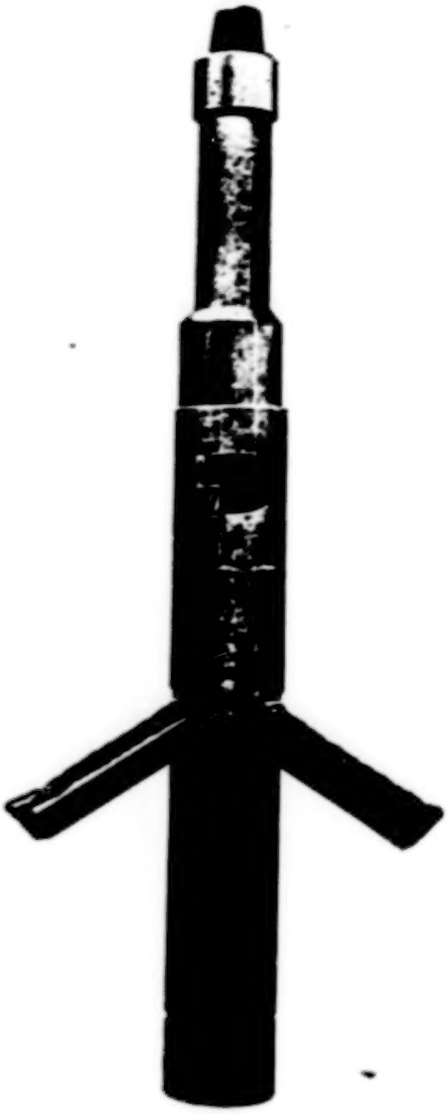

Figure 3 - Mechanical Cutter.

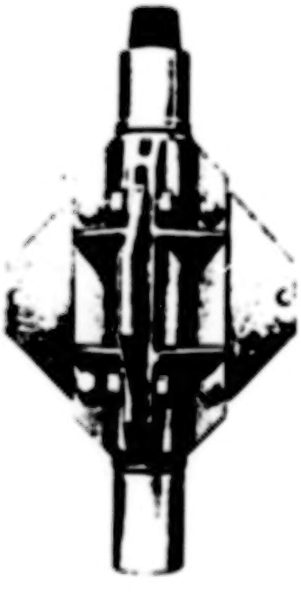

Figure 4 - Free-Wheeling Stabilizer.

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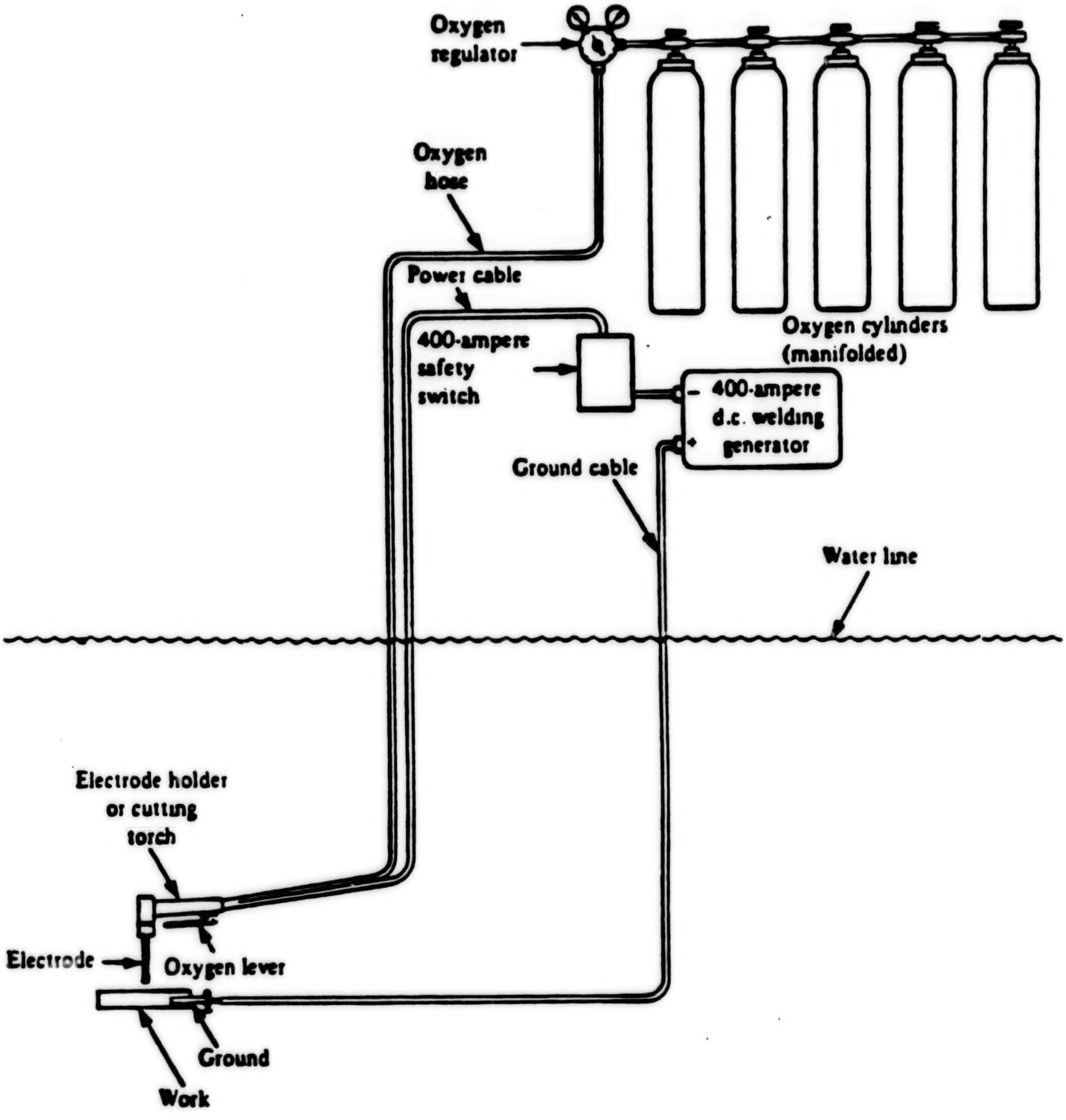

Figure 5 - Underwater Arc Cutting Equipment, Typical Arrangement

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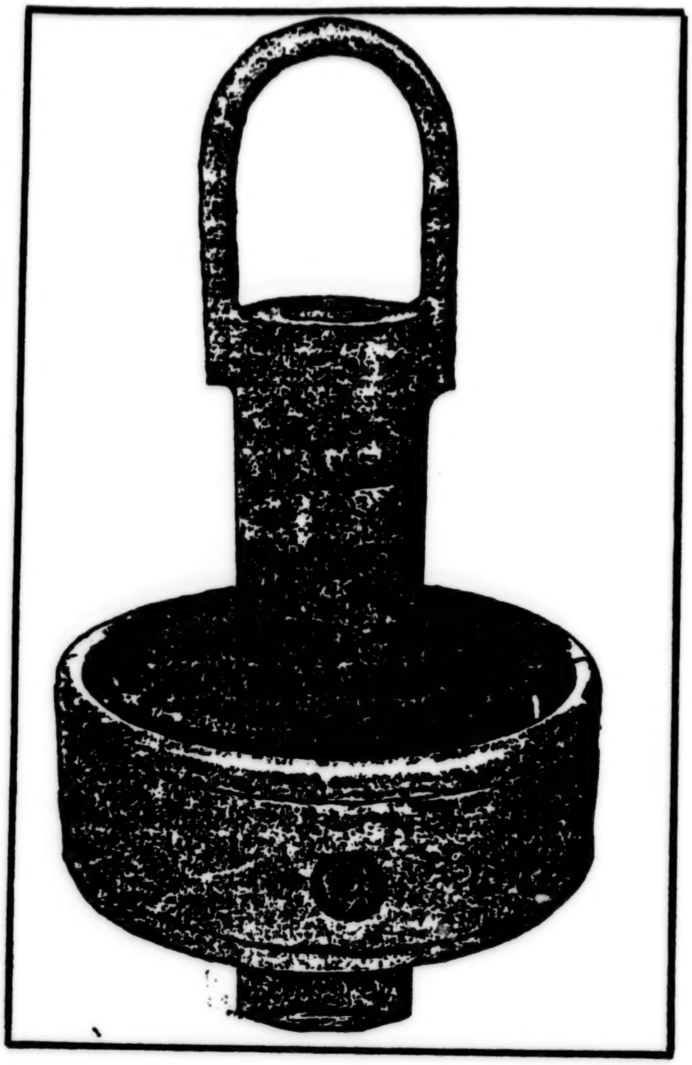
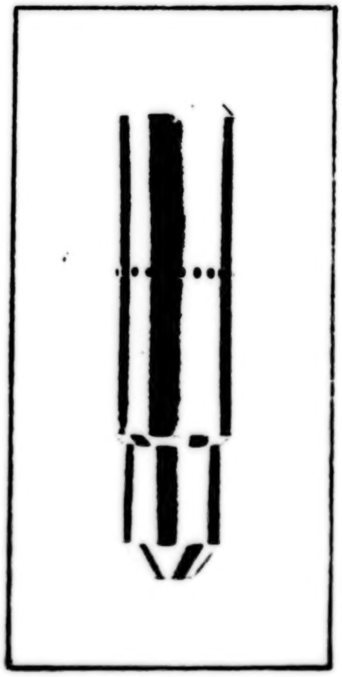


Figure 6 - Abrasive Sand-Type Cutter.

Figure 7 - Chemical Cutter.



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APPENDIX C

FINAL ACTION PLAN TO IMPLEMENT ENDANGERED SPECIES ACT FORMAL CONSULTATION ON PLATFORM REMOVALS IN THE GULF OF MEXICO

FINAL ACTION PLAN TO IMPLEMENT ENDANGERED SPECIES ACT FORMAL CONSULTATIONS ON PLATFORM REMOVALS IN THE GULF OF MEXICO (INCLUDING NATIONAL MARINE FISHERIES SERVICE CHANGES REQUESTED NOVEMBER 12, 1986)

The Minerals Management Service (MMS) Director noted in his September 9, 1986, letter to the National Oceanic and Atmospheric Administration's Assistant Administrator for Fisheries the need for procedures to facilitate expedited Endangered Species Act Section 7 formal consultations between the MMS and the National Marine Fisheries Service (NMFS) on a platform-by-platform or group-of-platforms basis. The following steps should be used to accomplish these expedited consultations.

1. Available information/literature on removal methods/effects may be helpful to the NMFS. Information/literature in NMFS files on turtles and the use/effects of explosives would also be helpful to the MMS. The MMS and NMFS shall provide each other with copies of such information at the earliest possible time. These source documents would be used, as relevant, for all evaluations and formal and informal consultations. They would be augmented as additional information is identified or becomes available.

2. The Gulf of Mexico (GOM) Outer Continental Shelf Region will receive from lessees or operators notification of proposed platform or structure removals in Federal waters. This notification should be received 30 days before the platform or structure is proposed to be removed and should contain necessary information regarding the proposed removal. If the information submitted is incomplete or does not include appropriate mitigation/monitoring provisions, the lessee/operator will be afforded the opportunity to modify the proposal.

3. The GOM Region will review the incoming notification for possible impacts on marine mammals and endangered sea turtles. If it is determined that a proposed structure removal "may affect" an endangered species or marine mammal, the GOM Region will prepare a summary evaluation of possible effects on the endangered species and/or marine mammals. The summary evaluation will normally address available information on parameters such as water depth, location, habitat information, the impulse pressures from the blast and species' sensitivity to them, turtle and marine mammal distribution, any mitigation measures proposed to reduce the impacts of the activity, and proposed monitoring measures. This evaluation will use, and include, the best scientific and commercial data that are available.

4. Upon receipt of a complete plan for structure removal, the GOM Region will normally complete the summary evaluation and forward it, along with the incoming removal plan and any other information used in arriving at the "may affect" determination, to the MMS headquarters (HQ) coordinator within 10 working days. Forwarding will normally be by DHL Overnight unless the material is short enough to justify transmittal by fax/zap. An information copy of this material will be sent equally expeditiously to the NMFS/St. Petersburg office, Attention: Chuck Oravetz or Paul Raymond. The lessee will be informed that the proposed removal should not occur until an NMFS biological opinion is issued.

5. If possible, the GOM Region will group proposed removals requiring formal consultations and transmit them and their summary evaluations in a single batch to MMS HQ and NMFS/St. Petersburg. This will reduce the number of consultations and assist, thereby, the NMFS in conducting the consultation and preparing the biological opinion.

6. When the MMS HQ coordinator receives a copy of the operator's removal notification and the GOM Region summary evaluation of impacts of the removal on sea turtles and marine mammals, he will phone the information to the NMFS HQ

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coordinator as soon as possible. Written confirmation of this notification will follow as expeditiously as possible.

7. When the GOM Region decides formal consultation is not required, one copy of the decision, including the summary evaluation and the operator's notification of proposed removal will be sent to the NMFS/St. Petersburg office; another copy, to the MMS HQ coordinator. The GOM Region will notify the operator that he can proceed with the proposed structure removal.

8. The NMFS will expedite each formal consultation, which will be based on the best available scientific and commercial data. Presumably, consultation will be completed and a biological opinion issued within 30 days "to the maximum extent practicable." If a biological opinion concludes "no jeopardy," it will contain an incidental take statement and any appropriate "reasonable and prudent measures" to minimize impacts of any projected incidental take, as well as terms and conditions to implement these measures. Although specific measures, terms, and conditions cannot be anticipated now, they will likely include an observer/monitoring program. The GOM Region staff may be able to obtain an early reading on these from NMFS/St. Petersburg before the opinion is completed, and they are encouraged to do so as part of the ongoing consultation process. Such information, although possibly incomplete, will help the GOM Region anticipate subsequent necessary decisions regarding the removal and any necessary or appropriate conditions.

9. The biological opinion issued by NMFS HQ will be hand delivered to or picked up by the MMS HQ coordinator and the results phoned expeditiously from MMS HQ to the GOM Region, followed by hard copy as soon as possible thereafter. The GOM Region will then notify the lessee/operator to proceed, with whatever conditions (if any) it considers necessary or appropriate.

The results of the first few or several expedited formal consultations will probably enable the MMS and NMFS to simplify consultation procedures. The following modifications could become appropriate.

1. Assuming no new information on effects, etc., is available, the MMS review, evaluation, and transmittal procedures described above would be followed for proposed removals similar to those previously subjected to formal consultation. However, the evaluation summary should note the MMS belief that a specific, previously issued biological opinion--including its incidental take measures, terms, and conditions--applies also to the new proposed removal. If it agrees, the NMFS would concur in writing as expeditiously as possible.

2. As new information on effects becomes available (documenting, for example, little effect from a given removal method or technique), a new formal consultation would presumably be needed for subsequent, "similar" proposed removals. The new consultation may result in a biological opinion with fewer, less restrictive incidental take measures, terms, and conditions.

3. Alternatively, if monitoring of previous removals shows "no effect" for a particular type/category of removal under similar or identical circumstances as one newly proposed, informal-consultation phone calls to NMFS HQ (from MMS HQ) and to NMFS/St. Petersburg (from the GOMR) may eliminate the need to consult formally. Such occasions and the circumstances should be fully documented, however, in subsequent correspondence between the MMS and NMFS headquarters and regional offices. Information copies of all regional-level correspondence should be sent to headquarters; all headquarters-level correspondence, to the regional offices.

END

DATE FILMED

01-15-92